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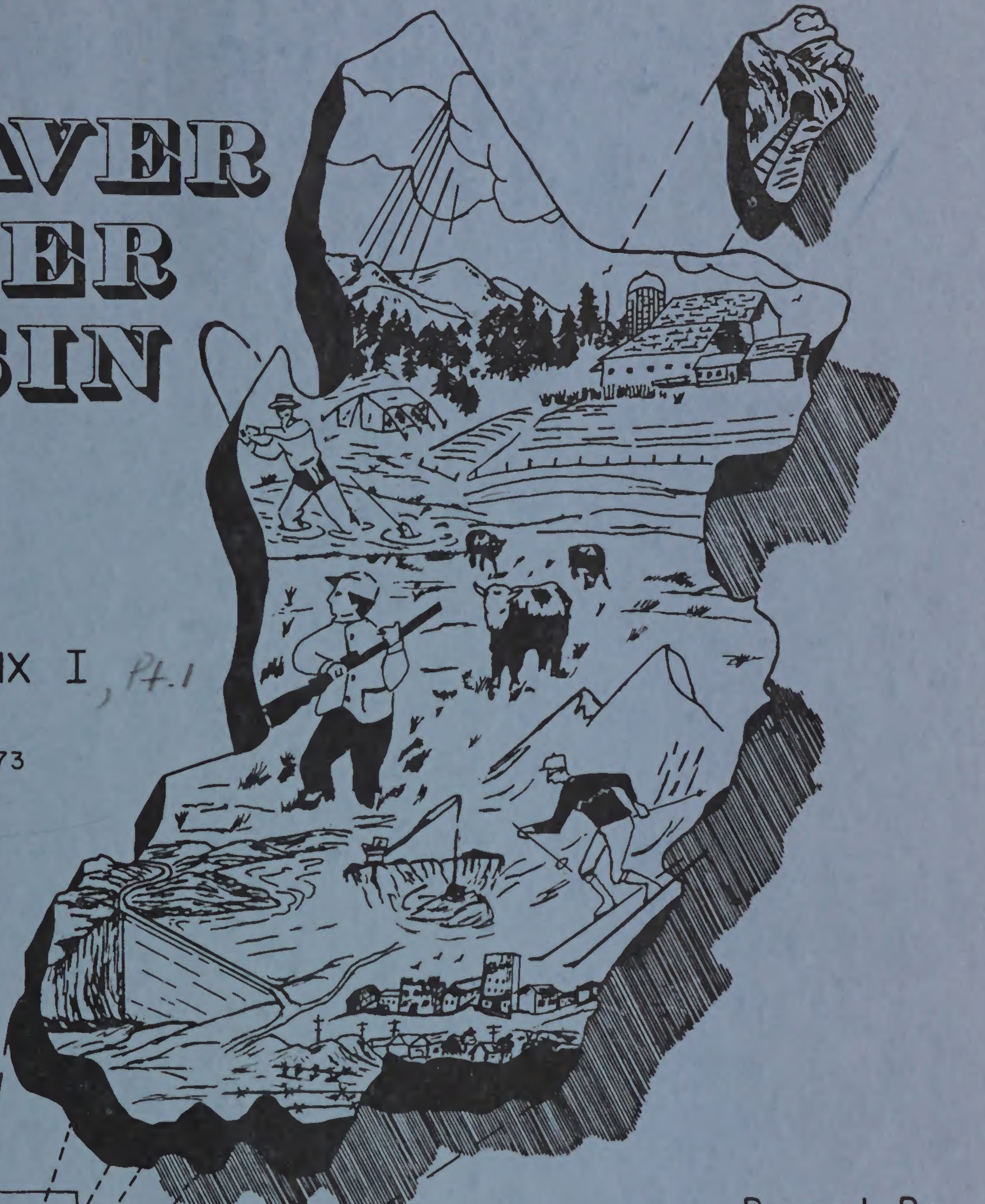
NATURAL RESOURCE INVENTORY

BEAVER RIVER BASIN



APPENDIX I, Pt.1

JUNE 1973

UTAH
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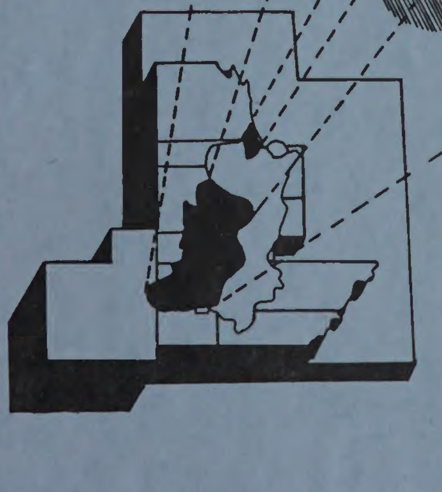

Prepared By
UNITED STATES
DEPARTMENT of AGRICULTURE
Economic Research Service – Forest Service
Soil Conservation Service
In cooperation with
UTAH STATE
DEPARTMENT of NATURAL RESOURCES

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APPENDIX I

NATURAL RESOURCE INVENTORY

BEAVER RIVER BASIN, UTAH-NEVADA

Prepared by

United States Department of Agriculture

Economic Research Service - Forest Service - Soil Conservation Service

in cooperation with

Utah State Department of Natural Resources

June 1973

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CATALOGING - PREP

The following publications have been prepared under the Beaver River Basin study:

Summary Report	
Appendix I	Natural Resource Inventory Soils Supplement
Appendix II	Present and Projected Resource Use and Management Water Related Land Use Supplement Water Budget Analysis Supplement
Appendix III	Resource Related Problems
Appendix IV	Economic Base and Needs
Appendix V	Potential Development Opportunities Irrigation Systems Supplement

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APPENDIX I

NATURAL RESOURCE INVENTORY

CONTENTS

Chapter		Page
	Introduction	1
	Size and Location	1
	Environment	1
	Nature of Investigation	2
I	Geology and Physiography	3
	History and Origin	3
	Northwestern Area	6
	Northeast Area	8
	Central Area	10
	Southwest Area	10
	Southeast Area	11
	Tintic Area	12
II	Climate	14
	Precipitation	14
	Temperature	22
	Growing Season	25
	Water Surface Evaporation	25
III	Land Resources	29
	Land Ownership and Administration	29
	Soils	32
	Native Vegetation	32
	Mineral Resources	39
IV	Water Resources	40
	Quantity	40
	Quality	52
V	Fish and Wildlife Resources	63
	Aquatic Wildlife	63
	Terrestrial Wildlife	68
	Wildlife Populations	74

FIGURES

Number		Page
1	Annual precipitation at two selected stations	19
2	Average annual precipitation compared to elevation for selected stations	20
3	Five-year average precipitation for 21 selected snow courses	22
4	Land ownership and administration	31
5	Annual flow at selected stations by frequency for 1956-1965 base period compared to long-term record	48
6	Relationship between discharge and dissolved solids at selected stations on the Beaver River in 1964	57
7	Relationship between water levels, specific conductance and pumpage for the Kanosh district	61
8	Increase in chemical constituents of water in the Beryl-Enterprise District	62

MAPS

	Following Page
Location	2
Physiographic Features	4
Generalized Geology	4
Annual Precipitation, Water Yield and Water Surface Evaporation	14
Selected Snow Measurement Stations	22
Land Ownership and Administration	30
Vegetation	32
Deer Range and Herd Units	72

TABLES

Number		Page
1	Major stratigraphic and time divisions	4
2	Annual precipitation from selected storage-gages	16
3	Mean monthly precipitation for selected stations	17
4	Average watershed precipitation for 1931-1960 and 1956-1965 periods	17
5	Mean monthly precipitation on irrigated lands	18
6	Mean monthly temperatures for valley areas	23
7	Mean monthly maximum and minimum temperatures for selected stations	24
8	Crop growing season	26
9	Water surface evaporation in irrigated areas	27
10	Land ownership and administration by county, watershed and subbasin	30
11	Areas of forested lands other than National Forests	31
12	Area of ten vegetative types by subbasin	33
13	Commercial forest resources	38
14	Summary of Geological Survey stream gaging records	41
15	Selected streamflow measurements	43-45
16	Monthly and annual flow volumes at twenty, fifty and eighty percent chance occurrence for selected stations	46
17	Monthly and annual flow volumes at 20, 50, and 80 percent chance occurrence for selected stations, 1956-1965	47
18	Streamflow volume by frequency for selected streams in the Cedar Valley subbasin	48
19	Comparison of water yield volume from Forest Service and Utah Agricultural Experiment Station maps	49
20	A comparison of water yields from Forest Service maps to yields used in water budget analysis	49
21	Volume of ground water storage by district and predicted decrease in storage resulting from a 50-foot decline in water levels	51
22	Sediment concentration from selected streams	53
23	Sediment concentration, Coal Creek	54-55
24	Hardness of surface water and temperature range of selected streams	58
25	Location and surface area of reservoirs stocked with game fish	64
26	Standing crop of all fish per one-tenth mile of stream section for selected locations	65
27	Environmental factors used as an indication of fish habitat quality	66
28	Physical and biological character of streams	67
29	Aerial beaver survey	71
30	Areas of summer and winter range by deer herd units	73
31	An evaluation of selected wildlife species by occurrence and trend	74

INTRODUCTION

This appendix provides a description of the natural resources of the Beaver River Basin, including geology and physiography, climate, land resources, water resources, and fish and wildlife resources. Soils, as part of the land resources, are described in a supplement to this appendix. Uses of these resources are described in Appendix II, "Present and Projected Resource Use and Management," and problems in Appendix III, "Resource Use and Management Problems". The economic characteristics are described in Appendix IV, "Economic Base and Needs" and opportunities for development in Appendix V, "Potential Development Opportunities."

SIZE AND LOCATION

The Basin contains 5,242,250 acres of which 69,660 acres are in Nevada and the remainder in Utah. Included are 162,370 acres in the Tintic Watershed that is separated from the remaining conterminous area. The Basin is 145 miles by 116 miles at the longest and widest points.

The Basin is located in southwestern Utah and southeastern Nevada in the southern part of the Great Basin. The east border lies in the High Plateaus of the Colorado Plateau Province, but the bulk of the area extends westward into the Basin and Range Province. It is bounded on the east and north by the Sevier River Basin, on the south by the Colorado River Basin, and on the west by the Great Salt Lake Basin. Utah counties within the Basin include Millard, Beaver, and Iron with minor areas of Sevier, Garfield, Juab and Washington; the small area in Nevada is in Lincoln County (maps following page 2).

ENVIRONMENT

The people live in small rural communities, the largest of which is Cedar City with a population of 8,946 (1970). Traditions and life styles are molded by forebears who overcame hardships as part of the Mormon migration and settlement of this area. These small communities are relatively free of most urban problems and living is at a more relaxed pace. Social life centers mostly around school and church activities.

The economy of the area is primarily agricultural, but tourism and mining are also important. Most agricultural enterprises are related to livestock production rather than cash crops. Major transportation routes, Interstate 15 and the Union Pacific Railroad, tie the Basin with market and supply areas in Utah to the north and Nevada and southern California to the south and west.

The area is separated into small enclosed hydrologic basins where surface waters evaporate upon reaching valley deserts. These valleys are classified as Upper Sonoran Desert. Here annual precipitation is as low as six inches over much of the area and vegetation is composed of low shrubs. These broad, extensive desert valleys are broken by mountain ranges that are steep and rugged, but limited in area and elevation. The desert area is sparsely populated and used primarily as rangeland for sheep and cattle.

In contrast, lofty mountain ranges on the east and south borders reach over 12,000 feet in elevation and are frequently capped with snow nine months of the year. Here precipitation reaches 40 inches annually and the principal vegetation is arboreal. These high mountain watersheds are limited in extent so water yields are critically important.

Settlements and cultivated lands are situated near small streams in the transition zone between the mountains and desert areas. The mountains moderate the severe climate and limitations of the desert, and provide an enviable environment. This environment is generally characterized by moderate temperatures, low humidity, clean air, clear skies, unmarred scenery, and open spaces. Here residents and visitors can enjoy the diverse climate provided by deserts and mountains, solitude, and recreation including skiing, golf, hunting, and fishing. Many environmental problems that plague other areas are lacking here. This pleasant environment is probably one of the most valuable natural resources.

NATURE OF INVESTIGATION

This inventory consisted mostly of the accumulation and evaluation of available published and unpublished data. Some field surveys were made to gather basic information not otherwise available.

The Basin was divided into 22 watersheds which were grouped into 5 hydrologic subbasins. Most data were collected, tabulated, and analyzed by watershed and assembled by subbasin. Other data were available only on a basin or subbasin basis.

LOCATION
NORTH PORTION
BEAVER RIVER BASIN
UTAH-NEVADA

APRIL 1971

LOCATION
SOUTH PORTION
BEAVER RIVER BASIN
UTAH-NEVADA

APRIL 1971

Chapter I

GEOLOGY AND PHYSIOGRAPHY

The majority of the Beaver River Basin lies in the Basin and Range Province of western Utah. The remaining eastern edge is in the High Plateaus of the Colorado Plateau Province.

The area in the Basin and Range Province is characterized by a series of north-south trending mountain ranges, separated by arid basins or valleys floored by detritus from the eroding mountains. Approximately 70 percent of the Basin and Range Province is covered with unconsolidated sediments. Most of the area within the province lies in the Great Basin section, an area of complex geologic structure, extending from the Wasatch to the Sierra Nevada and from southern Utah and Nevada to north of the Utah-Idaho border.

The mountains are very young in terms of geologic time. They are block-fault mountains and tend to form parallel ridges, generally less than 9,000 feet in altitude. Exceptions are the Tushar mountains of volcanic origin and over 12,000 feet in elevation; the Mineral mountains, a granitic plug; and the Pine Valley mountains, a laccolith.

Outstanding geologic features of the area are: (1) complex geology; (2) structural rather than erosional valleys; (3) pleistocene lakes; (4) two different kinds of rock debris in every valley, (5) dry lake beds or flood plains in the central parts of the valleys, with gravel fans rising to the base of bordering mountains; (6) various kinds of evaporite deposits, and (7) various metal resources.

HISTORY AND ORIGIN

A brief resume of the geologic history and origin will help to understand the present geology and topographic features of the individual basins and mountain ranges. The maps following page 4 show the general geologic and physiographic features. Table 1 shows the major geologic periods.

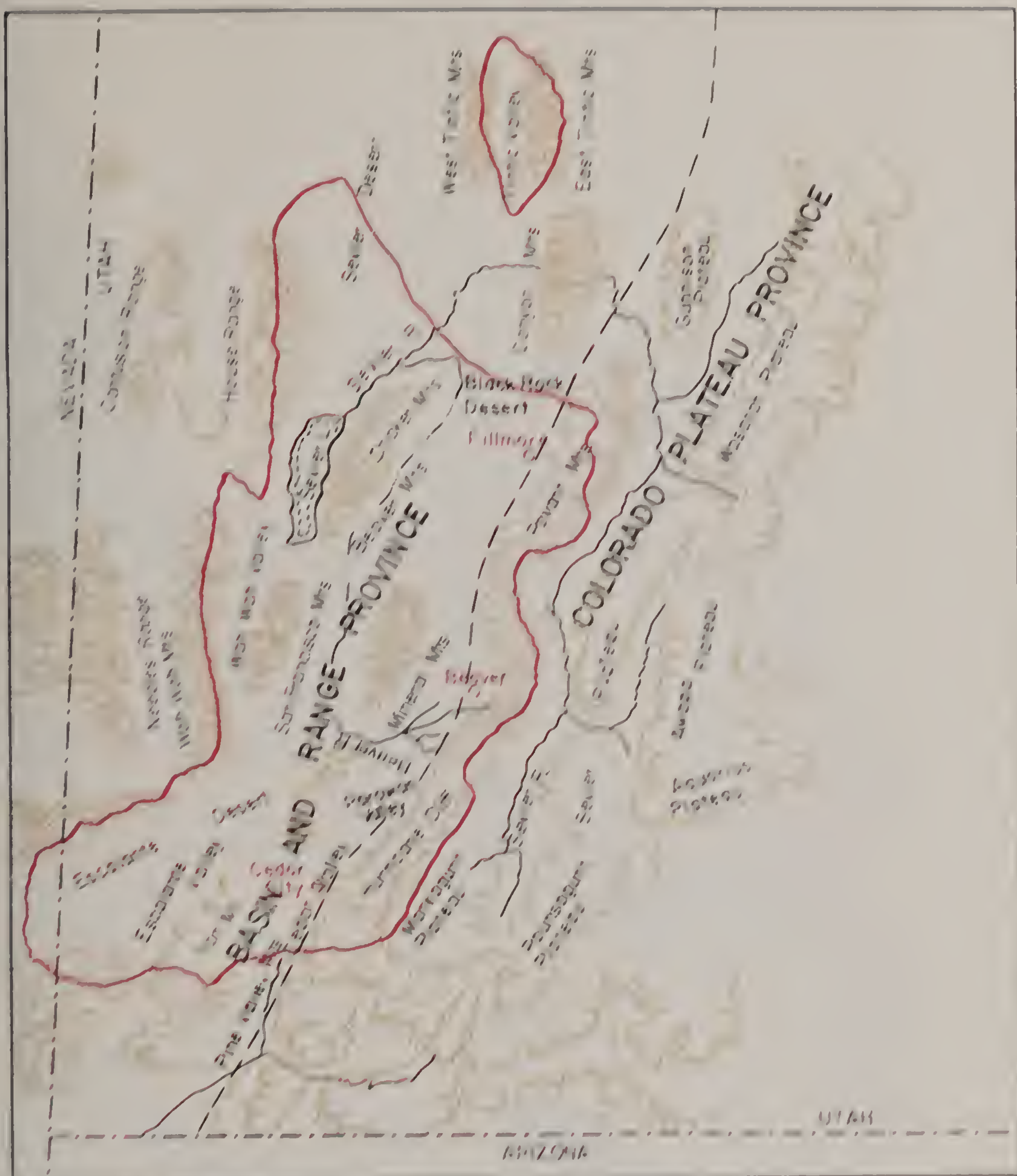
BASIN AND RANGE PROVINCE

The Basin and Range Province lies in the zone of enormous Laramide thrusts of the Cretaceous period. This Laramide movement probably

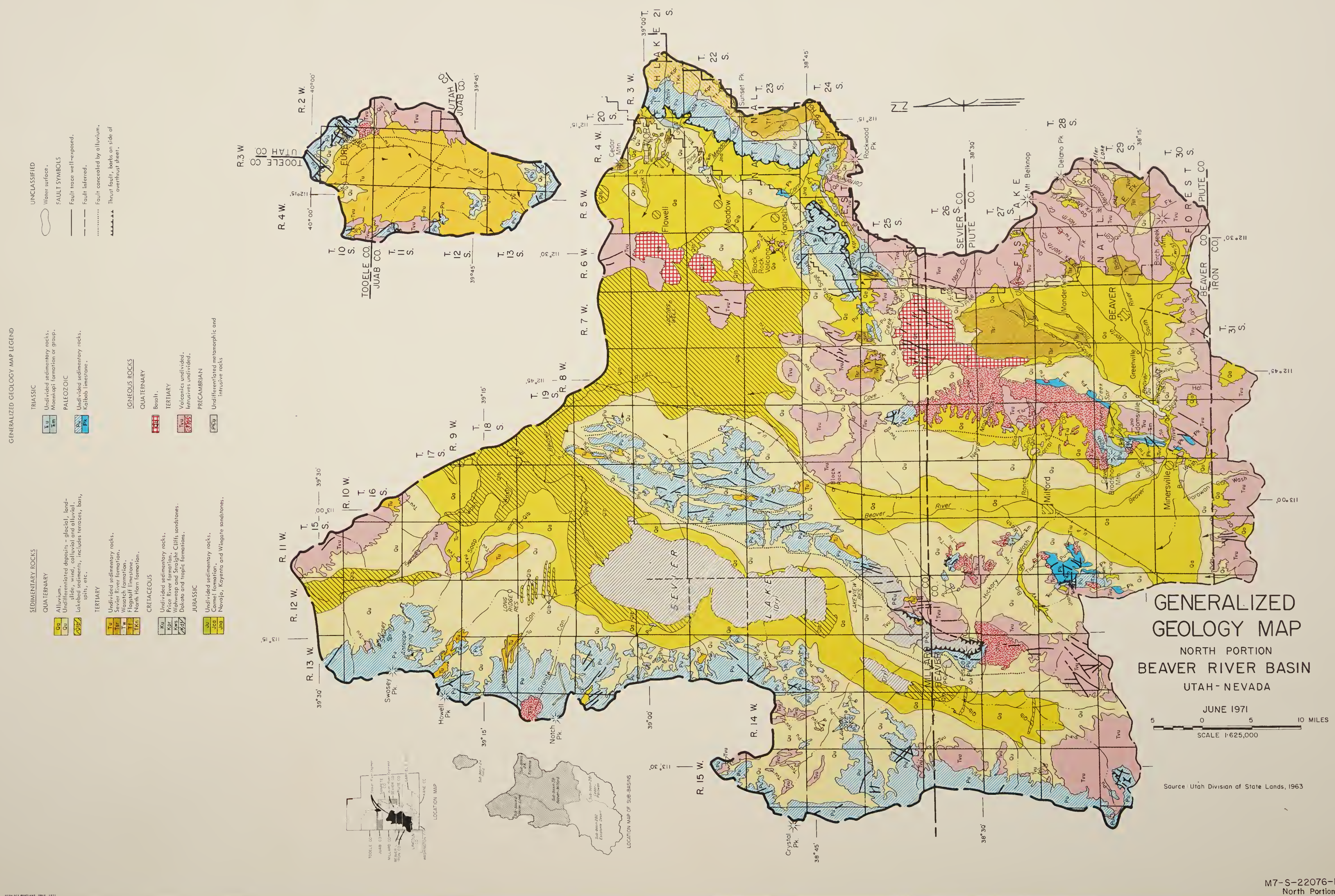
TABLE 1.--Major stratigraphic and time divisions, Beaver River Basin

Era or Erathem	System or Period	Series or Epoch	Estimated ages in millions of years
Cenozoic	Quaternary	Holocene (Recent)	
		Pleistocene	2-3
	Tertiary	Pliocene	12
		Miocene	26
		Oligocene	37-38
		Eocene	53-54
		Paleocene	65
Mesozoic	Cretaceous	Upper (Late) Lower (Early)	136
	Jurassic	Upper (Late) Middle (Middle) Lower (Early)	190-195
	Triassic	Upper (Late Middle (Middle) Lower (Early)	225
Paleozoic	Permian	Upper (Late) Lower (Early)	280
	Carboniferous Systems: Pennsylvanian	Upper (Late) Middle (Middle) Lower (Early)	
	Carboniferous Systems: Mississippian	Upper (Late) Lower (Early)	345
	Devonian	Upper (Late) Middle (Middle) Lower (Early	395
	Silurian	Upper (Late) Middle (Middle) Lower (Early)	430-440
	Ordovician	Upper (Late) Middle (Middle) Lower (Early)	500
	Cambrian	Upper (Late) Middle (Middle) Lower (Early)	570
Precambrian		Informal subdivisions such as upper, middle, and lower, or upper and lower, or younger and older may be used locally.	

Source: Geological Survey Bulletin 1350



PHYSIOGRAPHIC FEATURES
BEAVER RIVER BASIN
UTAH – NEVADA
June 1972
Approximate Scale 1 inch 25 Miles


GENERALIZED
GEOLOGY MAP
NORTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA
JUNE 1971
5 0 5 10 MILES
SCALE 1:625,000
Source: Utah Division of State Lands, 1963
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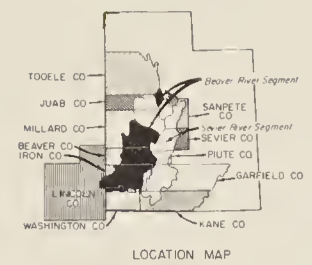
North Portion



GENERALIZED GEOLOGY MAP LEGEND

SEDIMENTARY ROCKS

QUATERNARY

- Qa — Alluvium.
- Qu — Undifferentiated deposits - glacial, landslide, wind, colluvial and alluvial.
- Qlb — Lakebed sediments, includes terraces, bars, spits, etc.

TERTIARY

- Tu — Undivided sedimentary rocks.
- Tsr — Sevier River formation.
- Tw — Wasatch formation.
- Tf — Flagstaff limestone.
- TKn — North Horn formation.

CRETACEOUS

- Ku — Undivided sedimentary rocks.
- Kpr — Price River formation.
- Kws — Wahweap and Straight Cliffs sandstones.
- Kdt — Dakota and tropic formations.

JURASSIC

- Ju — Undivided sedimentary rocks.
- Jca — Carmel formation.
- Jna — Navajo, Kayenta and Wingate sandstones.

TRIASSIC

- ꞓu — Undivided sedimentary rocks.
- ꞓm — Moenkopi formation or group.

PALEOZOIC

- Pu — Undivided sedimentary rocks.
- Pk — Kaibab limestone.

IGNEOUS ROCKS

QUATERNARY

- Qb — Basalt.

TERTIARY

- Tvu — Volcanics undivided.
- Tiu — Intrusives undivided.

PRECAMBRIAN

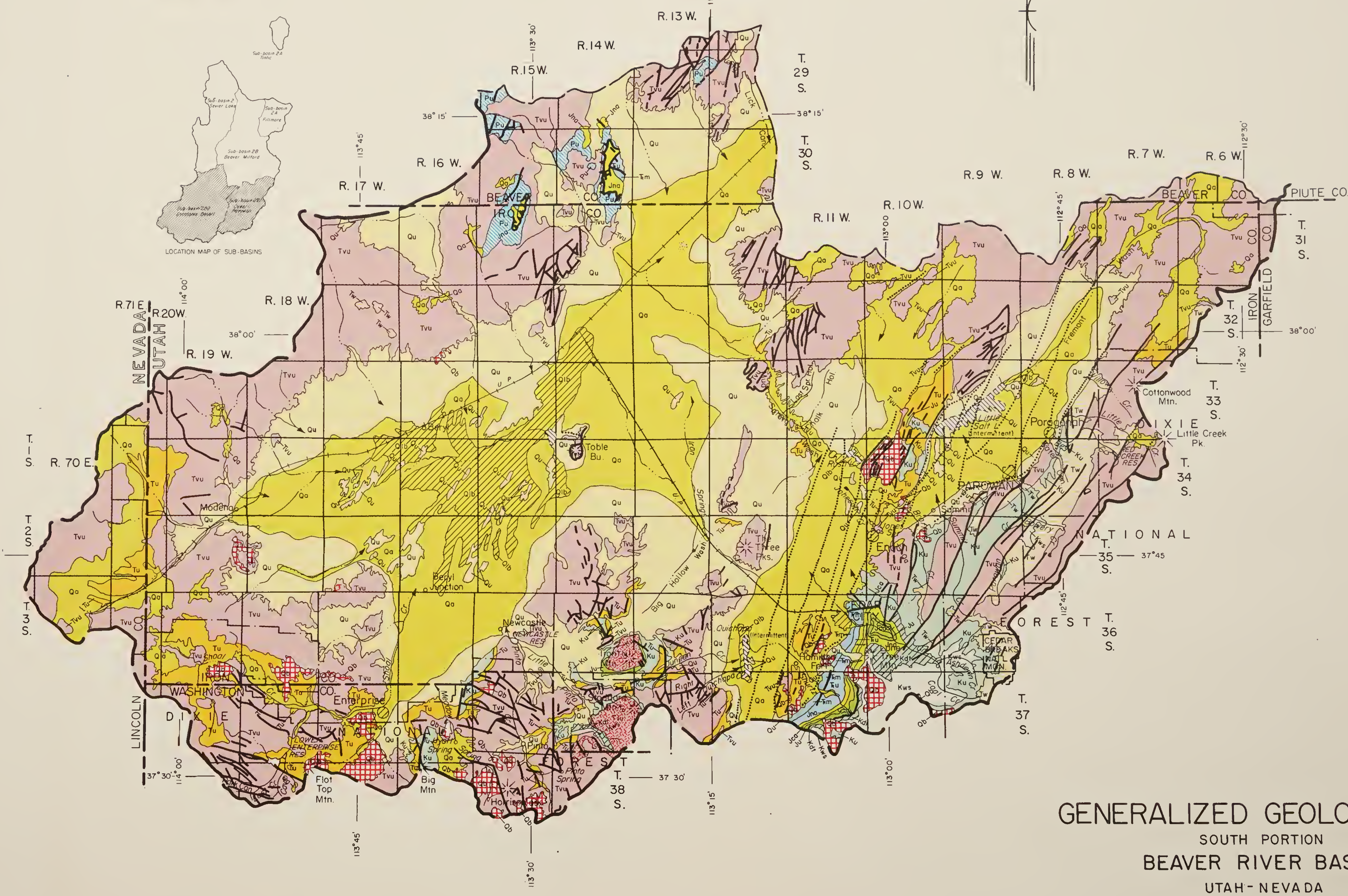
- P€u — Undifferentiated metamorphic and intrusive rocks.

UNCLASSIFIED

- Water surface.

FAULT SYMBOLS

- Fault trace well-exposed.
- Fault inferred.
- Fault concealed by alluvium.
- Thrust fault, barbs on side of overthrust sheet.



GENERALIZED GEOLOGY MAP
SOUTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA

JUNE 1971

5 0 5 10 MILES

SCALE 1:625,000

Source: Utah Division of State Lands, 1963

M7-S-22076-N
South Portion

continued into the early Cenozoic era. During this period, the region was one of high mountains and with exterior drainage. Eocene and Oligocene strata are partially absent here; however, Miocene formations are present and are locally very thick. Evaporite deposits, such as gypsum, magnesite, and borax along with clays and silts, are locally abundant. These clays and associated saline deposits could have formed only in arid basins of interior drainage, much like the basins today.

In late Miocene time, normal faulting began on a large scale, creating the Basin and Range Province. The deposits of that age were later tilted and truncated, forming angular unconformities below Pliocene deposits. As the new ranges were greatly elevated during the Pliocene epoch, the basins assumed a desert character similar to present times. The Pliocene is represented by strata up to 1,800 feet thick, including gypsum and salt deposits of 100 feet thick locally. At this point in geologic history, the basins were still deepening. Well defined fault scarps as well as faulting during historic times indicate that movement is still active.

Most of the north-south mountain ranges are complexly deformed paleozoic rocks consisting basically of limestone. In some areas, rocks consist mostly of sandstone, siltstone, and shale derived from volcanic rocks. At about the time block faulting began, which formed a horst and graben structure, extensive volcanic eruptions of lava and tuffs occurred in many areas. Most of the volcanic activity trended southwesterly and these block faulted extrusives aided in the formation of some mountain ranges, with the down-faulted block forming the valley floor. During and following faulting, materials were eroded from the mountains and debris was deposited in the valleys. The valley fill is basically composed of gravel, sand, silt, and clay beds ranging from 3,000 to 5,000 feet in depth. Recent activity along the faults has produced displacement in the gravel fans and valley fill along the bedrock, forming scarplets. This has created some of the present drainage anomalies.

Most of the valleys vary in altitude from 4,200 feet to 5,000 feet above sea level. Steep slopes bordering these valleys are cut by steep canyons with alluvial cones at their mouths and triangular facets on the spurs between. On the gentle slopes, broad alluvial fans merge into piedmont fans, extending in many cases nearly to the base of the next range. At the present time, the area is characterized by locally high erosion on the mountain ranges with deposition of alluvium on the valley floors during torrential summer rainstorms and high spring snow-melt runoff.

COLORADO PLATEAU PROVINCE

During the Laramide disturbance, rocks of the Colorado Plateau were thrown into large swells, with local monoclinal flexures. By

Oligocene times, the area had eroded to a low relief with established exterior drainage. Later, probably during late Cenozoic times, there was regional uplift with considerable normal faulting, forming the province.

The Colorado Plateau is now a system of tabular plateaus, cliff-bound mesas and colorful deep canyons. The area has a northeasterly trend of fault blocks, many capped with volcanic flows, forming plateaus higher than 9,000 feet elevation with a few at 11,000 feet. Tertiary sediments and gently dipping, basically nonmarine Mesozoic sediments, underlie these volcanics.

The area has a high structural rim formed by faulting. The western edge of the plateaus coincides with the relatively active seismic belt along the Hurricane fault and relates to the continued deformation in that area. Extrusive igneous rocks are abundant. Erosion along the western face is high, especially during torrential late summer rains. Alluvial fans are continually expanding with deposition on flood plains along the valley floors. Cedar and Parowan valleys are examples of such areas.

NORTHWESTERN AREA

The House Range and Sevier Desert are outstanding features in the northwestern area of the Basin. Three dominant peaks are Notch Peak (9,728), Howell Peak, and Swasey Peak. The House Range is a typical northerly trending "basin-range block", comprised almost entirely of Cambrian marine strata with gentle east to southeasterly dips. The steep westward face is a fault scarp, created when the range was elevated and tilted along a normal fault. The Cambrian limestones, quartzites, and shales which comprise most of the range, are underlain by the igneous Notch Peak intrusive. This intrusive is a granite porphyry and is very inconsistent in shape. It has intruded into several of the overlying sedimentary formations. Deformation of the overlying Cambrian rocks is slight and metamorphism is restricted to a small zone.

The Sevier Lake sink lies southeast of the House Range. This barren playa, about 30 miles long and 12 miles wide, is a structural depression associated with faulting. Once covered by the waters of Lake Bonneville, the area is now filled with alluvium and lake deposits of silt, clay, and sand with salts distributed throughout all deposits. The playa is ringed by coarser alluvial debris eroded from surrounding mountains.

The Cricket Mountains, east of Sevier Lake sink, form the northern end of a chain of north-south trending mountain ranges, including the Beaver Mountains and San Francisco Mountains. A fault, masked by alluvium, parallels the western base, dividing them from Sevier Lake sink.

The Cricket Mountains are composed of faulted Cambrian sedimentary rocks of several types. Several north-south trending faults are masked by unconsolidated sediments with many small faults running roughly perpendicular to the main fault pattern. The range is surrounded by alluvial-colluvial debris eroded from the range.

The Beaver Mountains, south of Sevier Lake sink, are the middle range in this chain of mountains. They are composed of Precambrian metasedimentary rocks in the southern half and Cambrian quartzites in the northern half. The northeast trending fault that runs south along the west side of the Cricket Mountains, crosses at the south end of the Beaver Mountains and divides these ranges from the San Francisco Mountains. The fault continues south along the east side of the San Francisco Mountains. The area dividing the two ranges is covered with Tertiary basaltic andesite flows. The Beaver Mountains themselves contain several north to northeast trending faults.

The San Francisco Mountains form the southern end of the north-south trending chain. The famous Horn Silver mine and the old ghost town of Frisco are located in this range. The San Francisco Mountains are the most prominent range in the area with a maximum elevation of about 9,700 feet. The axis of the northern part turns somewhat eastward and then continues to the Beaver Mountains.

The west side of the San Francisco Mountains rises steeply from the floor of Wah Wah Valley, while the east side rises more gently and is flanked by a series of low hills. Folding is of little importance, but an eroded anticline exists on the west limb. North-south trending faults have resulted in uplift and tilting of the range, forming a structural block between two faults. Large amounts of thrust faulting also appear in the range.

Rock types in the San Francisco Mountains vary from sedimentary to igneous intrusive and extrusive with some metamorphics. The eastern flank and northern part of the range near the Beaver Mountains is composed of volcanic flows and tuff. Small east-west faults have determined the location of Squaw Pass which divides the Precambrian and Cambrian limestones and quartzites with intruded monzonite in the northern part of the range from lava flows in the south. The monzonite intrusion has caused some doming of the sediments which generally dip away from the intrusive mass.

Streams have cut many canyons and gullies into the range; however, there are no perennial streams. Occasional summer cloudbursts are the main cause of erosion. Eroded debris is carried into Wah Wah Valley and Beaver River Valley during floods.

Wah Wah Valley, west of the San Francisco and Beaver Mountains, extends northward about 50 miles to the Sevier Lake sink. It is a structural valley approximately 25 miles wide associated with typical Basin and Range block faulting. The floor is covered with hundreds to thousands of feet of unconsolidated erosional sediments near the low center of the valley. The slopes around and above the valley floor are composed of coarser alluvial debris eroded from the Beaver and San Francisco Mountains on the east and Wah Wah Mountains to the west. These slopes form aprons and other erosional-depositional features including fans near the mouths of the many canyons and gullies entering the valley. These degradational forces result from high, spring snow-melt runoff and torrential summer storms.

The Wah Wah Mountains form part of the western boundary of the Beaver River Basin. These mountains are composed mostly of Cambrian rocks with some Ordovician sedimentary rocks. The rocks, with some variations, are three main types; limestone, quartzite, and shale. The northern part of the range is composed almost entirely of Cambrian rocks with numerous small east-west trending faults. The southern part is composed of a mass of Ordovician rocks and Tertiary volcanics. The Ordovician sediments are severely faulted and separated from the Cambrian rocks by a thrust fault, the Ordovician section being the upper plate. Volcanics form the southeast part of the range. These have flowed northward into the south end of Wah Wah Valley.

The slopes along the Wah Wah Range are covered with Quaternary colluvial-alluvial debris. Transportation of this eroded material is dependent primarily upon cloudburst flooding.

NORTHEAST AREA

Black Rock Desert is a wide expanse east of the Cricket Mountains. This extensive shadscale-greasewood plain has a low elevation near 5,000 feet. The area was once flooded by Lake Bonneville, leaving remnant lake deposits composed of clay and silt, which contain enough salt to prohibit agricultural use. The area is broken by basalt and basaltic andesite flows. The towns of Fillmore, Meadow, and Kanosh are on the eastern edge of this desert and at the toe of the Pavant Mountains.

The Pavant Mountains, forming part of the eastern boundary of the Basin, extend from Clear Creek northeastward to Round Valley, where the range is cut off sharply along a prominent fault scarp. The eastern, western, and northeastern slopes of the range are steep and stream gradients reach 1,000 feet per mile. The range is composed of sedimentary rocks except for the volcanic rocks at the southern end. These volcanics consist of latitic flows, breccias, and rhyolitic tuff. A few outcrops of volcanic rock to the north indicate the flows once extended farther in this direction.

The sedimentary rocks are highly erosive, consisting chiefly of brightly colored sandstones, shales, limestones, and conglomerates, most of which belong to the Wasatch formation of Eocene age. This formation also outcrops on the Markagunt Plateau in the southeastern part of the Basin. A fault block, composed of older limestones, shales, and quartzites of Paleozoic and Mesozoic age, is apparent along the western edge of the range with a plunging anticline at the south end.

The soft, sedimentary rocks supply considerable sediment and steep canyons favor rapid transportation to the valleys below. Medium intensity rain showers often produce floods.

South of Pavant Mountains, the towering Tushar Mountains dominate the landscape. Delano Peak, at 12,173 feet, is the highest in the Basin with other peaks nearly as high, making this the only extensive area above 9,500 feet elevation. The mountains extend from Clear Creek southward to Fremont Pass. Beaver River, the largest perennial stream in the Basin, has its origin within these mountains. The Tushar Mountains are deeply dissected and streams on both sides have cut deep canyons. Glaciation has taken place on all sides of the higher peaks. Small areas of limestone, dolomite, shale, sandstone, and quartzite of Permian, Triassic and Jurassic age are found southwest of Marysvale and fanglomerate beds of the Sevier River formation of Pliocene-Pleistocene age are found in the Clear Creek and Beaver River drainages. Elsewhere, the Tushar Mountain region is composed of volvanic breccias and flows.

The Tushar Mountains are geologically complex, but are generally composed of volcanic rocks that dip toward the west with fault systems on both sides. Alluvial fans and terraces are abundant along the western edge of the range with deposition of material on the fans occurring during the summer cloundbursts and during high snow-melt runoff. The steep gradients favor destructive flooding and high erosion in localized areas.

CENTRAL AREA

The Mineral Mountains, west of Beaver, have a maximum elevation of 9,587 feet at Granite Peak, which is primarily a granitic plug within the confines of an igneous shell with some exposed sedimentary rocks. There is folding of sedimentary rocks with an overthrust bring the lower and middle Cambrian sediments over middle and upper Cambrian limestones in the northern part of the range. The Mineral Range pluton occurred in late Cretaceous or early Tertiary times, and faulting in the range is believed to have been caused by forces related to this intrusion.

Volcanic activity during early Tertiary time laid down deposits at the southern end of the range. This was followed by renewed displacement along the older faults. This displaced the volcanics in the southern area and probably resulted in the uplift of the mountains to their present elevation. Middle and late Tertiary time left more volcanics, primarily rhyolite flows on the north-central part of the range.

During the Recent Epoch and into present times, there has been extensive erosion, especially in the unconsolidated northern volcanics. Generally, coarse debris was deposited on the sediment flanks and finer alluvial material on the bordering valley floors. Torrential summer rains contribute most of the energy needed for erosion and deposition processes. Both Corral Canyon and Ranch Canyon, on the western slope contain perennial streams, but these soon disappear upon reaching alluvial fans at lower elevations.

SOUTHWEST AREA

The Escalante Desert, south of Wah Wah Valley, is partially isolated by low hills and at present, is an interior drainage. Total depth of the alluvial fill is not known, but is more than 600 feet and could approach 5,000 feet in thickness in some areas, and stores a large amount of groundwater.

The low lying hills surrounding Escalante Valley are composed mostly of a wide range of Quaternary and Tertiary volcanics which provide detritus along the upper slopes of the valleys. Alluvium grades from coarser materials along the fans and aprons at the base of the hills to finer gravels, sands, and clays in the valley floor. Rock debris is carried to alluvial fans and on to the valley floor during normal rains which usually cause local flash flooding.

The east-west trending Pine Valley Mountains form the Basin's southern boundary. Major perennial streams are Shoal Creek, Little Pinto Creek, and Pinto Creek. Harrison Peak is the highest at 7,680 feet elevation. Sediment carried by the creeks are deposited in the south end of Escalante Valley where the streams are either diverted for irrigation or disappear into the alluvial fill of the valley.

Every period of the Paleozoic and Mesozoic eras is represented in this range with the exception of the Silurian. Sedimentary rocks on the north side of the mountains are overlain by the Piney Valley latite. This latite (a series of viscous flows) appears to have sealed the vent, forcing the remaining magma to intrude beneath the seal, forming the Pine Valley laccolith. The laccolith is monzonite porphry. The sedimentary cover overlying the laccolith has been completely removed by erosion. Alluvial fans and aprons are common on the north side of the range and spread onto the Escalante Valley floor. The foothills surrounding the southern end of the valley are highly susceptible to torrential rains which deposit alluvium forming fans and aprons.

SOUTHEAST AREA

The High Plateaus of the Colorado Plateau Province form the southeast and eastern boundary of the Basin. Although the contact between the Basin and Range Province and Colorado Plateau is transitional, generally the northeast trending Hurricane fault marks the change in the southeast area.

The headwaters of several drainages, from Coal Creek on the south to Little Creek on the north, originate on the Markagunt Plateau. Part of the western edge of the plateau is more than 10,000 feet high with the highest point, Brian Head, at 11,315 feet elevation. Cedar City, the largest town in the Basin, lies at the mouth of Coal Creek.

Strata in the Markagunt Plateau dip gently to the northeast. Sedimentary and volcanic rocks are exposed over much of the surface. The Wasatch formation is probably the most spectacular formation on the plateau and provides the scenic granduer of Cedar Breaks National Monument. This formation is composed chiefly of red, yellow, white, and gray limestones, sandstones, shales, and minor conglomerates of Eocene age. Cretaceous sandstones, shales, and coal beds underlie the Wasatch formation in this vicinity and on southward. North of Cedar Breaks the Wasatch sedimentary rocks are covered with volcanic latite flows and breccias that increase in thickness toward the north and east.

Many basaltic volcanic cones are scattered about the plateau surface, where black flows spread out as shields or follow valleys. Some valleys have been blocked, forming natural lakes such as Navajo Lake. Age of the volcanics ranges from possibly a century or two ago (Recent) to Pleistocene or Plicocene age.

Alluvial deposition along the west side of the plateau is locally heavy, especially near the mouth of the perennial streams. The Wasatch formation is soft and easily eroded, producing sediment found along streams, in alluvial fans, and on valley floors. Cedar and Parowan valleys are graben type structures covered with thick deposits of alluvium from the Markagunt Plateau.

TINTIC AREA

The Tintic area is not a contiguous part of the Beaver River Basin. It is located northeast of the Basin and is hydrologically part of the Sevier River Basin. Prominent physiographic features of the Tintic area are the West Tintic Mountains, East Tintic Mountains and Tintic Valley. These mountains form the western and eastern boundaries of the area. The foothills of a lesser range, the High Mountains, partially form the southern boundary.

This area consists of typical basin and range topography. The mountain ranges are north-south linear ridges of complexly deformed rocks consisting largely of limestone. They were folded and faulted and later divided into structural blocks by late Tertiary and Quaternary black faulting. The exposed rocks range in age from Precambrian to Recent and include rocks deposited during each period of the Paleozoic era. Four types of faults are found in these mountains: (1) faults formed during folding, (2) faults formed after folding but before volcanic activity, (3) postvolcanic mineralized faults and fissures, and (4) late normal faults of the Basin and Range type.

The mountains are separated by structural valleys. Pleistocene and Recent deposits are thickest and of greatest variety in these intermontane basins. These deposits become thinner as they progress up the mountain valleys, but some colluvial deposits extend to the tops of the highest ridges.

Tintic Valley is a fault-rimmed intermontane, desert basin. The valley drains southward from the divide toward Sevier Lake, but virtually all runoff from the intermittent streams seep into the valley alluvium. The base level of the valley that drains eastward from the crest of the East Tintic range is nearly 1,100 feet lower than the 5,300 foot base level elevation of Tintic Valley. Valley-fill deposits are about 7,200 feet thick. The valley and adjacent ranges include the eastern part of a belt of intrusive rocks extending from East Tintic Mountains to the Deep Creek Mountains.

The old mining towns of Eureka, Mammoth, and Silver City are located in the East Tintic Mountains. The important metals include silver, lead, and gold with some copper and zinc. Halloysite clay and silica rock are important products presently being mined.

The East Tintic Mountains, a tilted fault block, are 42 miles long and 1½ to 12 miles wide and trend north and south. The northern and southern limits are not sharply defined. The eastern slopes are steeper than the western, and most are more youthful in character. The highest point, Boulter Peak, attains an elevation of 8,306 feet, and the elevation at the main divide is 8,218 feet. The folds, thrusts, and transcurrent faults were formed by tectonic uplift during late Mesozioc time. The sedimentary rocks are folded and faulted and are partly overlain by volcanic tuffs, breccias, and extensive agglomerates. Locally, most of these rocks are concealed under alluvial deposits of several types. The most prominent folds are the North Tintic anticline, and East Tintic anticline, all in the northern part of the range.

In the northern and south central parts of the range, the youngest volcanic rocks are basalts, fine grained diabase dikes and sills. Volcanic activity was dominant in the central part. Here the sedimentary and extrusive igneous rocks are deeply dissected, exposing many dikes, sills, and small stocks which intrude most of the sedimentary rocks. Triassic and Jurassic rocks underlie some of the Precambrian and Paleozoic rocks below thrust faults in the southeastern part.

The West Tintic Mountains are similar to the East Tintic Mountains, except on a smaller scale. The Tertiary and Quaternary rocks are of volcanic and continental origin and vary widely in composition and thickness. Late Precambrian and Paleozoic sedimentary rocks are exposed on the lower plate of the Sheeprock thrust fault.

Formations of the Lake Bonneville group in both ranges contain abundant gastropods and ostracodes. Rounded pebbles and small cobbles deposited as beaches, bars, and spits are also found.

Chapter II

C L I M A T E

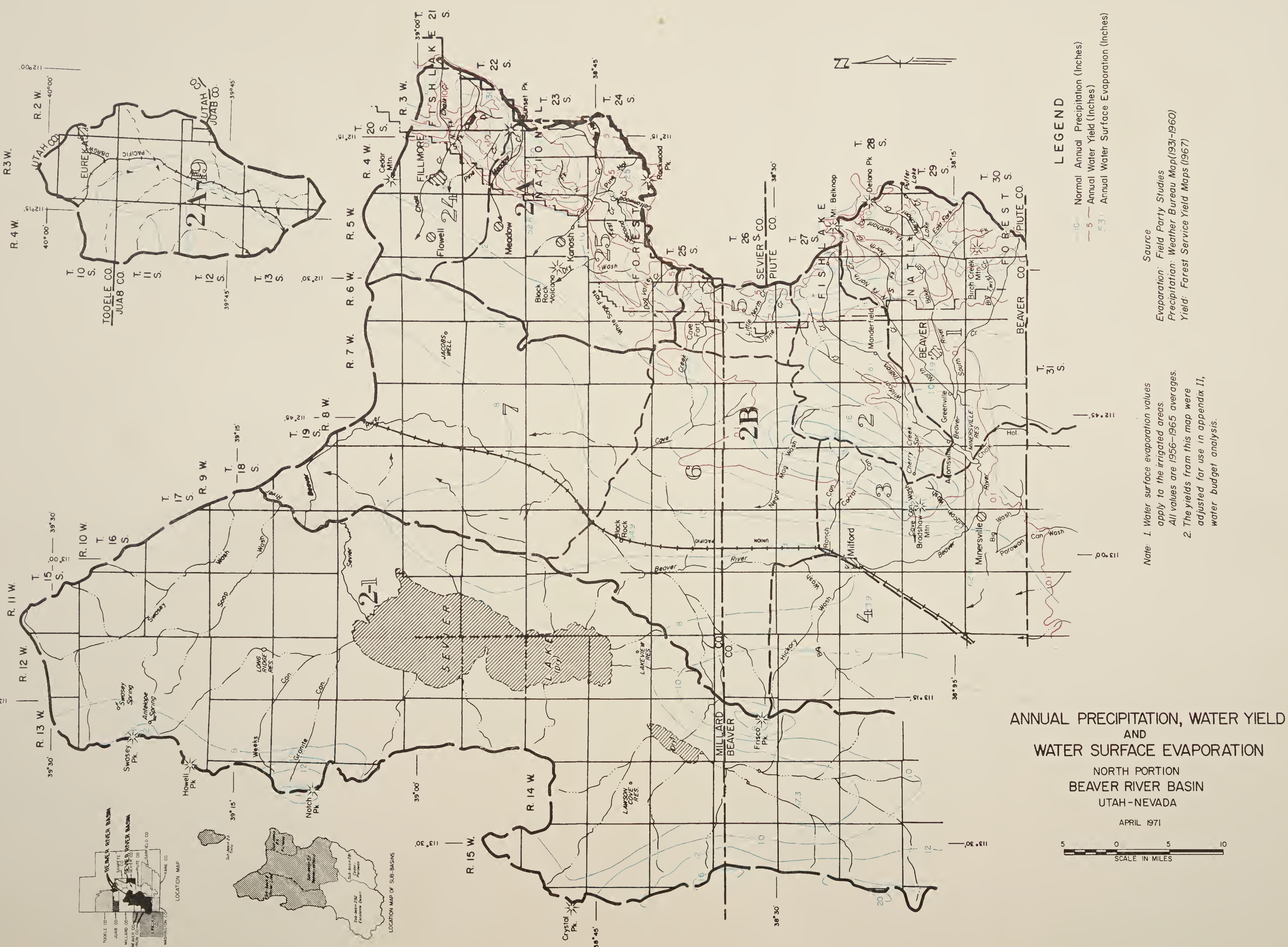
Climatic data were evaluated for the base-period calendar years, 1956 through 1965. Averages for this ten-year period vary from the long-term norms (1931-1960) compiled by the National Weather Service (U.S. Weather Bureau). This base period was selected as other hydrologic data were inadequate for earlier periods.

There are two distinct climatic areas. One, the Escalante Desert-Escalante Valley-Sevier Lake area, has the driest climate with an average annual precipitation of approximately 8 inches and a mean temperature of 49.5°F. The other includes the high plateau front area from Fillmore to Cedar City and the Pine Valley mountain front. This area has an average annual rainfall of 10.9 inches and a mean annual temperature of 49.4°F. The only notable exception is the Fillmore-Kanosh area which has an average annual precipitation of 13.4 inches and an average mean annual temperature of 52.2°F.

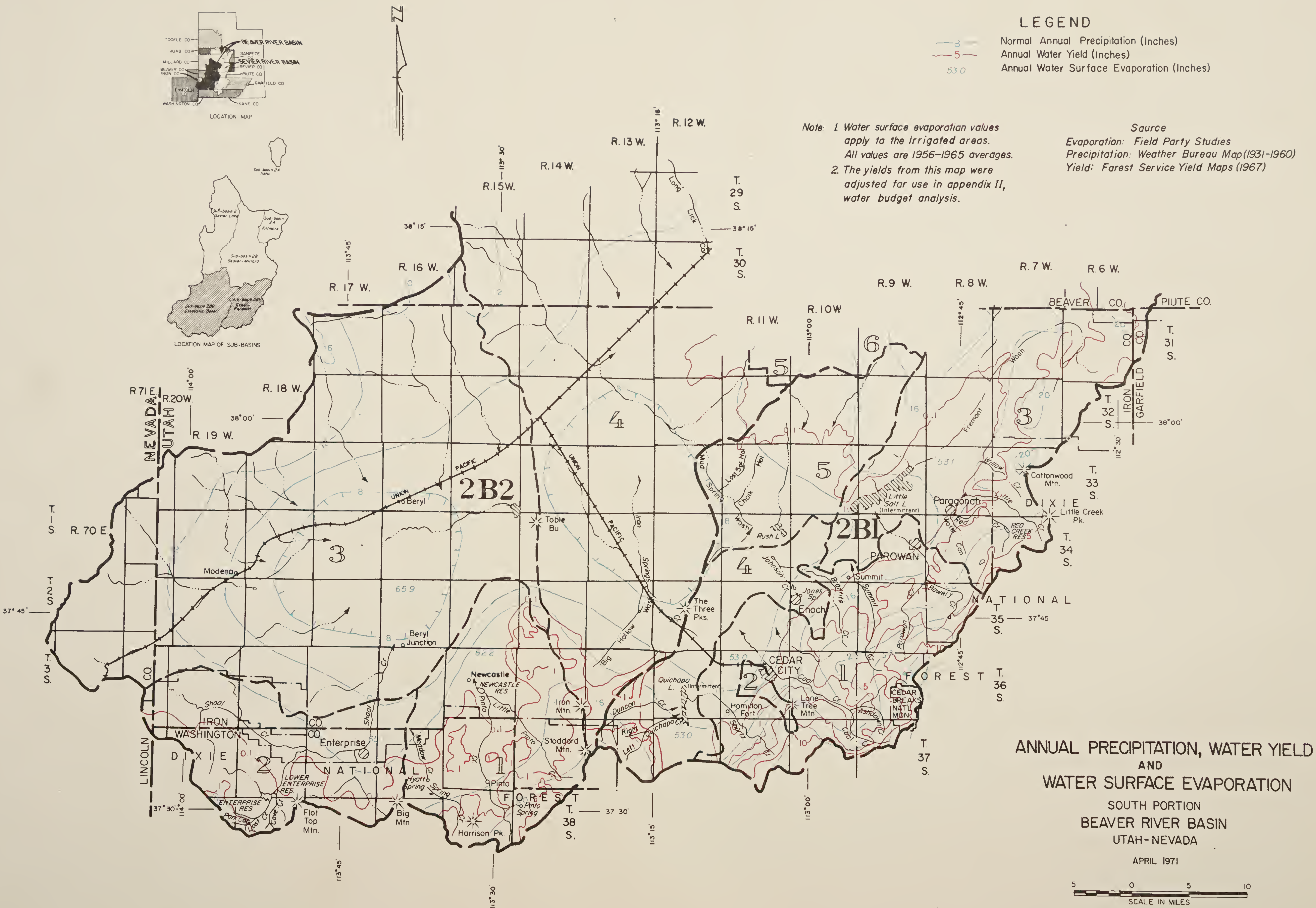
Precipitation varies from 40 inches in the upper elevations of the Tushar Mountains to about 6 inches in the Sevier Lake area. Sunny skies prevail most of the year. Sunshine ranges from 47 percent possible sunshine during December to 82 percent during September. Winds average 7 to 12 miles per hour with strong gusts occurring occasionally, usually associated with storm systems. Prevailing winds are from the southwest modified by topographical features which cause local turbulence. There are no records of tornadoes within the Basin.

PRECIPITATION

Precipitation volumes by watersheds for the 1931 to 1960 period were taken from normal precipitation maps prepared by the National Weather Service. The areas between isohyetal lines were planimetered, summed, and adjusted to agree with the total watershed area (map following page 14). Precipitation volume between isohyetal lines was calculated by multiplying the adjusted acreage by the average of these lines.



ANNUAL PRECIPITATION, WATER YIELD
AND
WATER SURFACE EVAPORATION
NORTH PORTION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1971



ANNUAL PRECIPITATION, WATER YIELD AND WATER SURFACE EVAPORATION

SOUTH PORTION
BEAVER RIVER BASIN
UTAH-NEVADA

APRIL 1971

Precipitation storage gages located in the mountains along the eastern and southern edges of the Basin indicate total precipitation on the principal water yielding areas. Annual precipitation records for these stations were taken from National Weather Service storage gage precipitation data for the Western United States (Table 2).

Records during the ten-year period do not indicate that weather stations were moved more than a few hundred feet. The stations are scattered and so do not provide close station to station correlation except in the Cedar City-Parowan area. Monthly and annual precipitation for selected stations were taken from the National Weather Service annual summaries of climatological data (Table 3).

The 1931 to 1960 precipitation volume was adjusted to the 1956-1965 base period using available climatological data. Snow survey data were used to indicate the relationship of 1931-1960 precipitation to 1956-1965 precipitation in the mountain areas not monitored by climatological stations. The 1956-1965 average annual precipitation was less than the 1931-1960 average throughout the Basin, with the exception of Chalk Creek Watershed (Table 4).

Annual precipitation on valley areas for the 1931-1960 average was correlated with station normals to arrive at a factor for adjusting monthly distribution of rainfall. Precipitation on irrigated lands in Milford and Cove Creek Watersheds was taken from station normals with no adjustment required (Table 5).

Records for Cedar City Airport and Beryl-Enterprise stations were not complete for the 1956-1965 period. Missing data were supplied by correlation with the Cedar City Powerhouse and Enterprise stations, respectively. Cedar City Powerhouse recorded an annual rainfall of 4.95 inches in 1959 and 18.36 inches in 1965, compared to the long-term normal of 10.27 inches. Figure 1 shows the variation of annual precipitation at Parowan and Modena from 1891-1965.

The rate of increase with elevation, and the total annual precipitation for any particular location are influenced by local topographic features along with other factors. Cedar City Airport, at an elevation of 5,690 feet, had a ten-year average precipitation of 9.8 inches. Cedar Breaks National Monument, at an elevation of 10,360 feet, had an average precipitation of 27.0 inches. Figure 2 shows the relationship between elevation and annual precipitation for selected stations.

Table 2.--Annual precipitation from selected storage-gages, Beaver River Basin, 1956-1965

Station	Elevation	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	Average
	Feet	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Cedar Breaks National Monument	10,360	19.0	41.7	27.0	21.5	24.6	26.6	27.7	24.7	30.6	--	27.0
Cedar City College Range	8,135	12.8	32.0	20.8	22.4	20.9	24.0	19.8	20.0	--	33.4	22.9
Chalk Creek #2	8,000	--	--	18.6	29.0	23.2	23.5	23.3	32.1	37.7	38.3	28.2
Little Grassy Creek	6,100	--	--	--	--	15.2	17.6	20.6	16.0	16.8	23.8	18.3
Panguitch Lake Ranger Station	8,200	9.3	22.7	12.3	10.0	13.4	15.7	12.7	14.5	18.5	13.4	14.2
Webster Flat	9,200	16.7	45.8	31.8	27.9	28.2	29.4	30.1	30.3	31.6	48.4	32.1
Yankee Reservoir	8,700	--	--	--	--	15.0	23.7	18.8	19.7	22.8	35.0	22.5

Source: Storage-Gage Precipitation Data For The Western United States; U. S. Weather Bureau.

TABLE 3.--Mean monthly precipitation for selected stations, Beaver River Basin, 1956-1965

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Beaver	0.65	1.15	0.90	0.87	0.86	0.49	0.81	1.26	1.03	0.69	0.82	0.47	10.00
Black Rock	0.60	0.73	1.23	1.10	0.82	0.52	0.43	0.61	0.65	0.52	1.01	0.47	8.69
Cedar City Airport	0.48	0.88	1.10	0.99	0.85	0.35	0.65	1.34	0.93	0.69	0.87	0.62	9.76
Cove Fort	0.75	1.23	1.52	1.77	1.32	0.53	0.55	1.26	1.03	0.66	1.06	0.92	12.61
Enterprise	1.06	1.31	1.46	1.24	0.82	0.41	0.57	0.68	1.04	0.88	1.48	1.13	12.08
Enterprise Beryl Jct.[a]	0.74	0.57	0.88	0.96	0.62	0.50	0.58	0.74	0.95	0.57	0.95	0.59	8.65
Fillmore	1.34	1.85	1.84	1.87	1.33	0.62	0.28	0.84	1.13	0.68	1.32	1.03	14.16
Kanosh	1.00	1.47	1.51	1.86	1.19	0.61	0.45	0.81	1.13	0.63	1.17	0.84	12.67
Lund	0.47	0.51	0.64	0.86	0.59	0.32	0.53	0.87	0.64	0.64	0.82	0.49	7.38
Milford Airport	0.51	1.81	0.95	0.99	0.65	0.46	0.18	0.40	0.83	0.51	0.85	0.49	7.63
Minersville	0.55	0.88	0.97	1.04	0.78	0.35	0.26	0.80	0.84	0.56	0.81	0.54	8.38
Modena	0.39	0.53	0.61	0.66	0.68	0.45	0.67	0.92	0.80	0.83	1.04	0.57	8.15
Parowan	0.94	1.27	1.74	1.18	0.98	0.43	0.93	1.20	0.81	0.71	0.98	0.78	11.95
Wah-Wah Ranch	0.23	0.46	0.61	0.64	0.77	0.36	0.44	0.97	0.67	0.68	0.77	0.33	6.93

[a]Average of years of record, 1960 to 1965.

Source: U.S. Weather Bureau annual summaries of climatological data.

TABLE 4.--Average watershed precipitation for 1931-1960 and 1956-1965 periods, Beaver River Basin

Watershed and Subbasin		1931 - 1960 May-September	1931 - 1960 October-April	1931 - 1960 Annual[a]	1956 - 1965 May-September	1956 - 1965 October-April	1956 - 1965 Annual[a]
		Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet	Acre-feet
2-1	SEVIER LAKE	372,620	450,260	822,880	335,360	409,740	745,100
2A-19	Tintic	67,220	93,880	161,100	68,560	76,040	144,600
2A-24	Chalk Creek	50,080	104,530	154,610	50,580	105,580	156,160
2A-25	Corn Creek	100,100	197,930	298,030	99,100	182,100	281,200
2A	FILLMORE	217,400	396,340	613,740	218,240	363,720	581,960
2B-1	Beaver	130,840	223,600	354,440	111,210	187,830	299,040
2B-2	Wildcat Creek	56,730	94,900	151,630	48,220	79,720	127,940
2B-3	Minersville	93,550	147,200	240,750	78,580	132,480	211,060
2B-4	Milford	43,450	59,100	102,550	36,500	60,280	96,780
2B-5	Cove Creek	24,690	41,750	66,440	22,960	34,240	57,200
2B-6	Black Rock	125,890	193,070	318,960	105,750	173,760	279,510
2B-7	Jacobs Well	115,430	170,220	285,650	96,960	153,200	250,160
2B	BEAVER-MILFORD	590,580	929,840	1,520,420	500,180	821,510	1,321,690
2B1-1	Coal Creek	109,360	229,840	339,200	99,520	172,380	271,900
2B1-2	Green's Lake	2,560	6,040	8,600	2,380	4,650	7,030
2B1-3	Red Creek	133,940	210,330	344,270	117,870	168,260	286,130
2B1-4	Quichapa Creek	38,470	61,740	100,210	35,390	59,270	94,660
2B1-5	Rush Lake	48,240	73,860	122,100	41,490	62,780	104,270
2B1-6	Other	5,700	7,620	13,320	4,840	6,550	11,390
2B1	CEDAR-PAROWAN	338,270	589,430	927,700	301,490	473,890	775,380
2B2-1	Pinto Creek	76,170	133,410	209,580	69,310	126,740	196,050
2B2-2	Shoal Creek	56,500	100,710	157,210	50,850	94,670	145,520
2B2-3	Beryl	224,590	318,640	543,230	199,880	296,340	496,220
2B2-4	Big Hollow	167,340	249,030	416,260	148,830	231,600	380,430
2B2-5	Other	3,590	5,250	8,840	3,200	4,880	8,080
2B2	ESCALANTE DESERT	528,080	807,040	1,335,120	472,070	754,230	1,226,300
	Basin total	2,046,950	3,172,910	5,219,860	1,827,340	2,823,090	4,650,430

[a]Sum of May-September and October-April precipitation. The 1931-1960 total differs by one to four percent from annual precipitation taken from Weather Bureau Map.

TABLE 5.--Mean monthly precipitation on irrigated lands[a], Beaver River Basin, 1956-1965

Watershed		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
2-1	Sevier Lake	0.23	0.46	0.61	0.64	0.77	0.36	0.44	0.97	0.67	0.68	0.73	0.24	6.80
2A-19	Tintic	0.91	1.09	1.19	1.70	1.34	0.75	0.72	1.34	0.92	0.67	1.18	0.81	12.62
2A-24	Chalk Creek	1.15	1.55	1.54	1.57	1.12	0.52	0.24	0.71	0.95	0.57	1.11	0.86	11.90
2A-25	Corn Creek	0.92	1.36	1.40	1.72	1.10	0.57	0.42	0.75	1.04	0.58	1.08	0.78	11.78
2A	FILLMORE	0.99	1.34	1.37	1.66	1.19	0.61	0.46	0.93	0.98	0.61	1.12	0.82	12.08
2B-1	Beaver	0.62	1.10	0.86	0.84	0.82	0.47	0.78	1.21	0.99	0.66	0.79	0.45	9.60
2B-2	Wildcat Creek	0.51	0.82	0.90	0.96	0.72	0.32	0.24	0.74	0.78	0.52	0.76	0.50	7.81
2B-3	Minersville	0.54	0.87	0.96	1.03	0.77	0.35	0.26	0.79	0.83	0.55	0.80	0.53	8.28
2B-4	Milford	0.51	0.81	0.95	0.99	0.65	0.46	0.18	0.40	0.83	0.51	0.85	0.49	7.63
2B-5	Cove Creek	0.75	1.23	1.52	1.77	1.32	0.53	0.55	1.26	1.03	0.66	1.06	0.92	12.61
2B-6	Black Rock	0.60	0.73	1.23	1.10	0.82	0.52	0.43	0.61	0.65	0.52	1.01	0.47	8.72
2B-7	Jacobs Well	0.60	0.73	1.23	1.10	0.82	0.52	0.43	0.61	0.65	0.52	1.01	0.47	8.72
2B	BEAVER-MILFORD	0.59	0.90	1.09	1.11	0.85	0.45	0.41	0.80	0.82	0.56	0.90	0.55	9.03
2B1-1	Coal Creek	0.92	1.25	1.72	1.17	0.97	0.42	0.92	1.19	0.80	0.70	0.97	0.77	11.81
2B1-2	Green's Lake	0.48	0.87	1.09	0.98	0.84	0.35	0.64	1.33	0.92	0.68	0.86	0.61	9.66
2B1-3	Red Creek	0.95	1.28	1.76	1.19	0.99	0.43	0.94	1.21	0.82	0.72	0.99	0.77	12.05
2B1-4	Quichapa Creek	0.48	0.87	1.09	0.98	0.84	0.35	0.64	1.33	0.92	0.68	0.86	0.61	9.66
2B1-5	Rush Lake	0.95	1.28	1.76	1.19	0.99	0.43	0.94	1.21	0.82	0.72	0.99	0.77	12.05
2B1-6	Other	0.55	0.88	0.97	1.04	0.78	0.35	0.26	0.80	0.84	0.56	0.81	0.54	8.38
2B1	CEDAR-PAROWAN	0.72	1.07	1.40	1.09	0.90	0.39	0.72	1.18	0.85	0.68	0.91	0.68	10.60
2B2-1	Pinto Creek	1.02	1.26	1.41	1.20	0.79	0.40	0.55	0.65	1.00	0.85	1.42	1.09	11.66
2B2-2	Shoal Creek	0.71	0.62	0.88	0.97	0.62	0.54	0.62	0.71	0.97	0.62	0.97	0.62	8.85
2B2-3	Beryl	0.71	0.62	0.88	0.97	0.62	0.54	0.62	0.71	0.97	0.62	0.97	0.62	8.85
2B2-4	Big Hollow	0.46	0.50	0.63	0.84	0.58	0.31	0.52	0.85	0.63	0.69	0.94	0.35	7.30
2B2-5	Other	0.55	0.88	0.97	1.04	0.78	0.35	0.26	0.80	0.84	0.56	0.81	0.54	8.38
2B2	ESCALANTE DESERT	0.69	0.78	0.95	1.00	0.68	0.43	0.51	0.74	0.88	0.67	1.02	0.64	9.00
Basin mean		0.64	0.91	1.08	1.10	0.88	0.45	0.51	0.92	0.84	0.64	0.94	0.59	9.50

Sources: (1) Normal Annual Precipitation Map prepared by the U. S. Weather Bureau, published cooperatively by the Utah State Engineer, Utah Power Board and the U. S. Department of Agriculture, Soil Conservation Service, (2) U. S. Weather Bureau annual summaries of climatological data.

a/ In watersheds without irrigated lands, precipitation values are for valley areas.

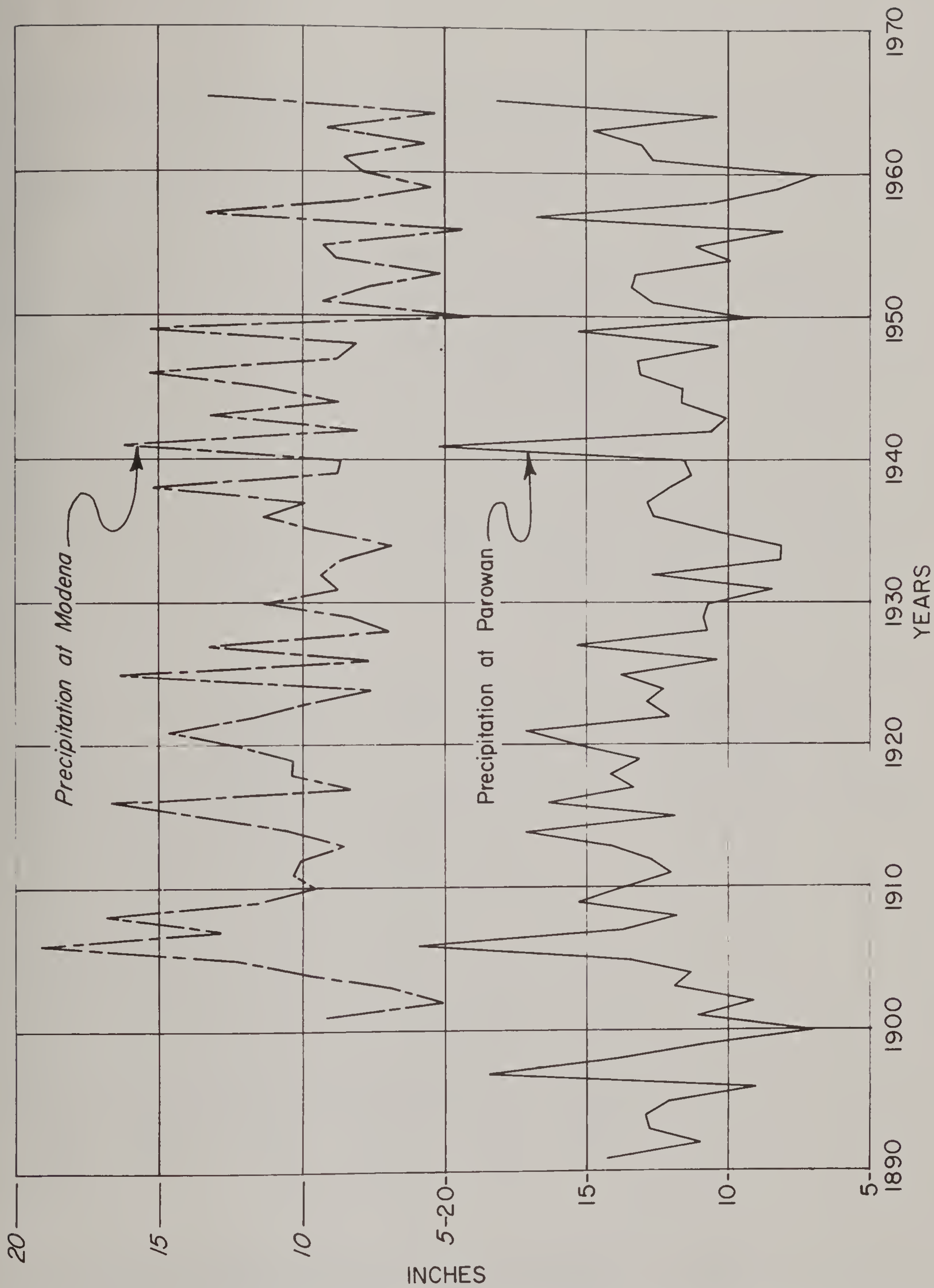


Figure 1: Annual precipitation at Modena and Parowan. Beaver River Basin, 1891-1965
Source. National Weather Service (Weather Bureau) annual summaries of climatological data.

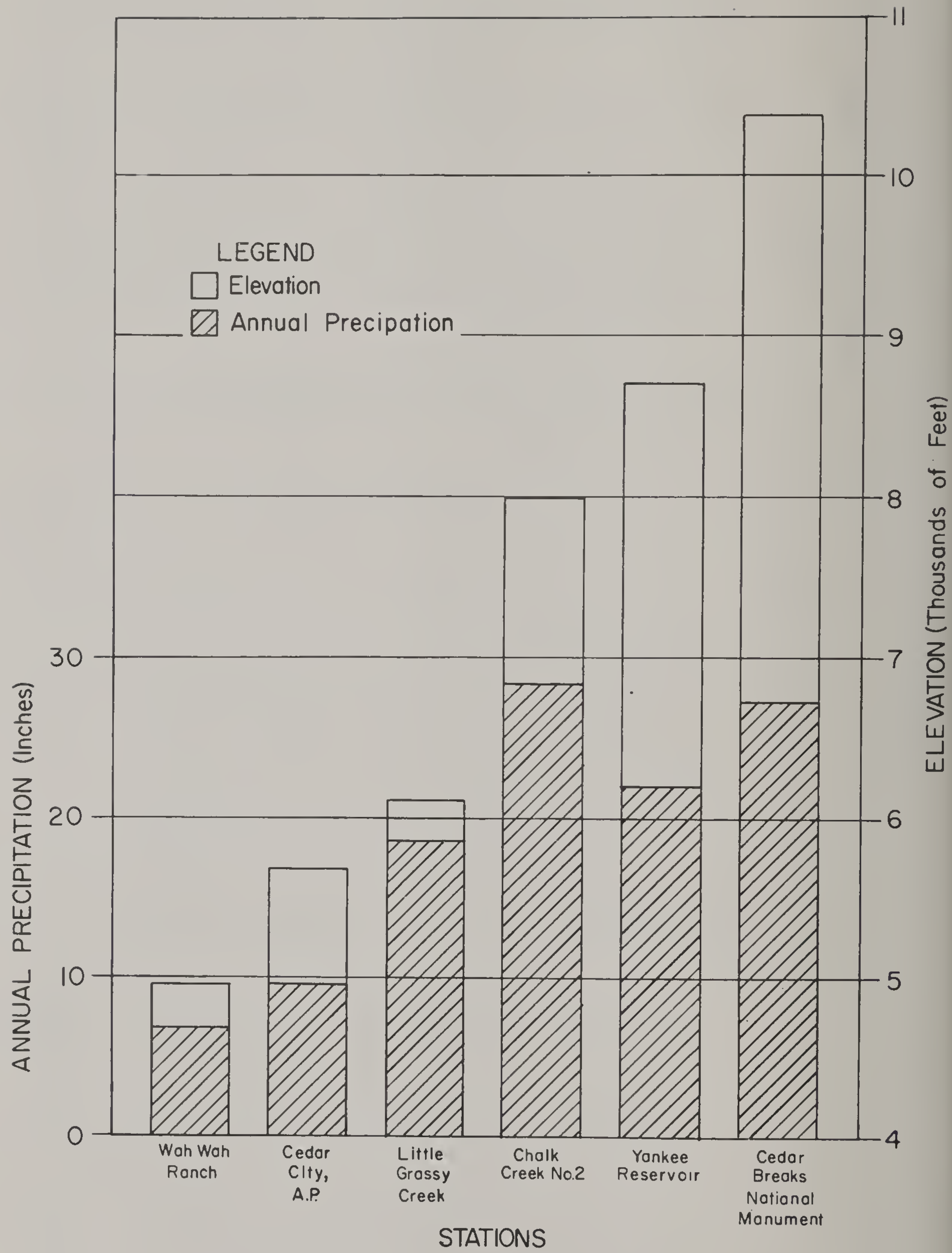


Figure 2: Average annual precipitation compared to elevation for selected stations, 1956–1965 Beaver River Basin.

Source: National Weather Services (Weather Bureau) annual summaries of climatological data.

Storage - gage Precipitation Data for the Western United States; U.S. Weather Bureau.

Ten percent or less of the average annual precipitation is received during the months of June and July at some stations. For example, the Minersville area receives 7 percent or 0.6 inches of rainfall during this period. If the rainfall were evenly distributed, the two month total would be 1.4 inches or 17 percent.

Precipitation is influenced by two main seasonal storm patterns. During the winter and early spring months frontal storms from the Pacific Northwest contribute significant amounts of moisture in the Fillmore-Kanosh area, and to a lesser degree in the Beaver, Cedar City and Enterprise areas. Fillmore receives 5.8 inches or 49 percent of its annual precipitation during February, March and April. Beaver and Escalante Valleys receive a greater proportion of precipitation in August and September from thunderstorms than other areas. A meteorological phenomenon known as the Nevada or Southern Utah Low also influences the area during the transition period between the winter frontal storms and summer thunderstorms. These high altitude low pressure systems cause vertical movements of air and result in widespread precipitation. The total accumulated precipitation with an increase in altitude under these conditions is less than with winter frontal systems.

The location of 21 snow courses are shown on the map following page 22. Figure 3 shows the precipitation data for these courses. The 8 northern stations were arbitrarily selected as those north of Gooseberry Ranger Station. This figure shows a declining precipitation trend from 1939 thru 1967. Total precipitation on southern snow courses is less than on the northern courses.

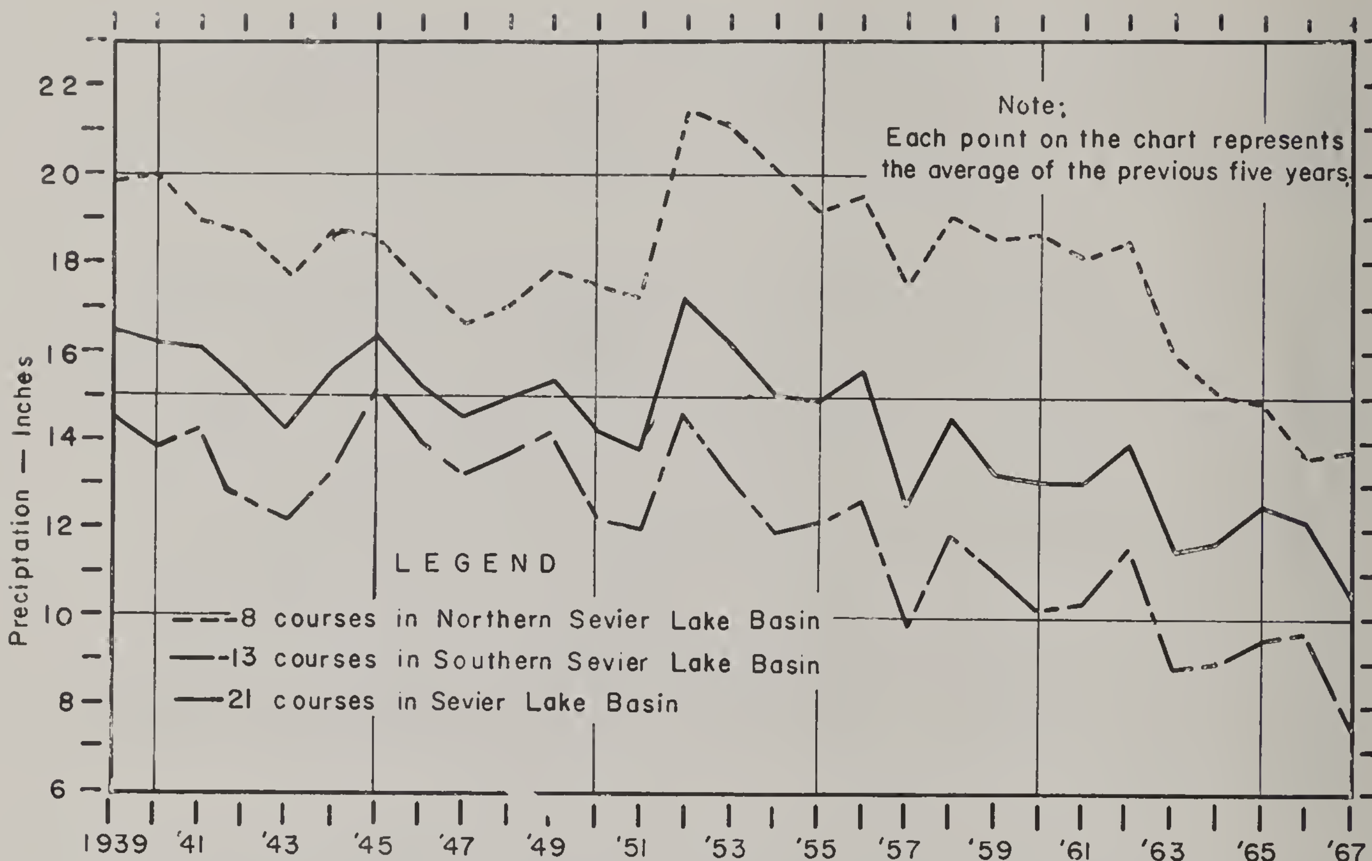


Figure 3: 5—Year average precipitation for 21 selected snow courses.

April 1 reading for years 1939 thru 1967

Sevier Lake Basin

TEMPERATURE

Temperature varies with latitude and elevation; there is about $1\frac{1}{2}^{\circ}$F. decrease in mean annual temperature with each degree increase in latitude and 3°F. decrease with each 1,000 foot increase in elevation. Of the two, elevation has the greatest influence. Mean monthly temperatures for the valley areas were taken from National Weaterh Service (Weather Bureau) Climatological Data (Table 6).

Temperatures above 100°F. are not uncommon during summer months at the lower elevations. Low relative humidity makes these high temperatures more bearable. Temperatures below zero are recorded most years. Prolonged periods of extreme cold are not common as mountain ranges protect the area from the continental arctic air masses.

SELECTED SNOW MEASUREMENT STATIONS
SOUTHERN UTAH
Beaver River Basin
Utah

INDEX

11K11	G.B.R.C. Headquarters
11K3	Mammoth R.S. Cottonwood Creek
11K4	Gooseberry Reservoir
11K5	Huntington – Horseshoe
11K9	Seeley Creek R.S.
11K10	G.B.R.C. Meadows
11K36	Ree's's Flot
11L2	Gooseberry R.S.
12L11	Shingle Mill
11L3	Fish Lake
12L6	Kimberly Mine
12L9	Merchant's Valley
12L8	Otter Lake
12L7	Big Flat
11M1	Widtsae-Escalante Summit
12M7	Panguitch Lake
12M8	Bryce Canyan
12M1	Cedar Breaks
12M3	Webster Flot
12M4	Duck Creek
12M6	Long Valley Junction

LEGEND

Snow Course

Snow Course and Storage Precipitation Goge

Snow Course, Soil Moisture Station and Storage Precipitation Gage

LOCATION MAP

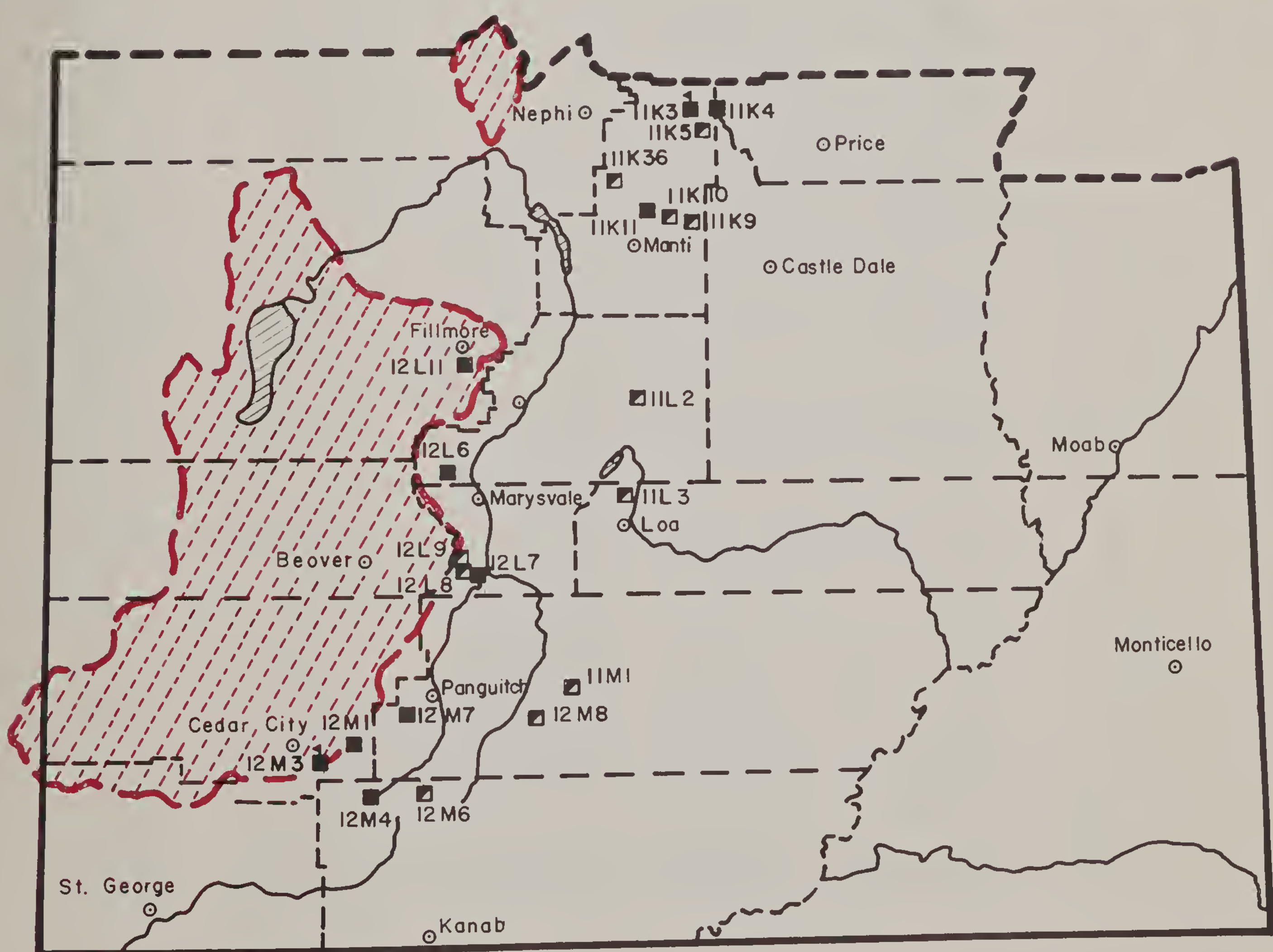


TABLE 6.--Mean monthly temperatures for valley areas, Beaver River Basin, 1956-1965

Watershed		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
		°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
2-1	Sevier Lake	27.7	33.8	39.4	48.5	57.8	68.0	75.6	73.7	64.2	53.0	37.7	30.2	50.8
2A-19	Tintic	27.3	32.4	39.4	48.4	58.3	68.2	74.6	73.2	62.8	52.2	37.5	30.4	50.3
2A-24	Chalk Creek	29.3	35.1	40.6	49.3	58.3	67.9	75.8	73.6	64.8	54.5	39.4	32.0	51.7
2A-25	Corn Creek	29.8	36.2	42.2	50.7	59.7	69.1	76.9	74.6	65.9	55.6	40.1	32.3	52.7
2A	Fillmore	28.8	34.6	40.7	49.5	58.8	68.4	75.8	73.8	64.5	54.1	39.0	31.6	51.6
2B-1	Beaver	28.2	32.0	36.6	45.4	53.7	63.3	69.6	68.2	59.6	49.9	36.3	28.2	47.6
2B-2	Wildcat Creek	28.2	32.0	36.6	45.4	53.7	63.3	69.6	68.2	59.6	49.9	36.3	28.2	47.6
2B-3	Minersville	26.8	32.2	37.9	47.0	56.1	66.4	73.6	72.3	62.0	51.4	36.0	29.4	49.2
2B-4	Milford	26.6	32.2	38.0	47.1	56.3	66.7	74.0	72.7	62.3	51.5	36.0	29.5	49.4
2B-5	Cove Creek	27.7	31.4	35.3	44.6	53.7	63.8	72.2	70.2	61.2	50.8	37.0	30.9	48.2
2B-6	Black Rock	27.9	33.5	39.5	49.1	56.9	65.9	73.0	71.5	62.0	51.8	37.0	30.2	49.9
2B	Beaver-Milford	27.6	32.2	37.3	46.4	55.1	64.9	72.0	70.5	61.1	50.9	36.4	29.4	48.6
2B1-1	Coal Creek	29.3	33.5	38.2	47.2	56.3	66.8	73.9	71.9	63.0	53.3	38.1	32.0	50.4
2B1-2	Green's Lake	29.3	33.5	38.2	47.2	56.3	66.8	73.9	71.9	63.0	53.3	38.1	32.0	50.4
2B1-3	Red Creek	29.3	33.9	38.6	47.3	56.1	66.0	72.0	70.1	62.1	52.9	38.8	32.7	50.0
2B1-4	Quichapa Creek	29.3	33.5	38.2	47.2	56.3	66.8	73.9	71.9	63.0	53.3	38.1	32.0	50.4
2B1-5	Rush Lake	26.9	32.2	37.9	47.0	56.1	66.4	73.6	72.3	62.0	51.4	36.0	29.4	49.2
2B1-6	Other	26.9	32.9	37.9	47.0	56.1	66.4	73.6	72.3	62.0	51.4	36.0	29.4	49.2
2B1	Cedar-Parowan	28.5	33.1	38.2	47.2	56.2	66.5	73.5	71.7	62.5	52.6	37.5	31.2	49.9
2B2-1	Pinto Creek	27.3	32.8	37.1	46.3	54.2	63.1	69.2	68.2	58.7	49.9	36.0	29.4	47.7
2B2-2	Shoal Creek	27.3	32.8	37.1	46.3	54.2	63.1	69.2	68.2	58.7	49.9	36.0	29.4	47.7
2B2-3	Beryl	28.6	33.9	38.2	46.5	54.4	65.2	72.1	70.8	61.9	52.0	37.7	31.5	49.4
2B2-4	Big Hollow	27.5	33.3	38.8	47.6	56.2	66.0	72.7	71.4	61.9	51.9	36.7	30.5	49.6
2B2-5	Other	26.9	32.2	37.9	47.0	56.1	66.4	73.3	72.3	62.0	51.4	36.0	29.4	49.2
2B2	Escalante Des.	27.5	33.0	37.8	46.7	55.0	64.8	71.4	70.2	60.6	51.0	36.5	30.0	48.7
Basin mean		28.0	33.3	38.7	47.7	56.6	66.5	73.7	72.0	62.6	52.3	37.4	30.5	49.9

Source: U. S. Weather Bureau annual summaries of climatological data.

TABLE 7.--Mean monthly maximum and minumum temperatures for selected stations, Beaver River Basin, 1956-1965

Station	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Annual Average	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Beaver	43.7	13.3	45.7	18.2	51.2	20.8	61.0	28.4	70.8	35.6	81.9	42.3	88.5	48.8	86.0	48.6	78.4	39.6	69.0	30.0	52.8	19.2	46.3	15.4	64.6	30.0
Cedar City A.P.	42.3	16.3	45.9	21.2	51.7	24.7	61.4	32.9	71.3	41.2	83.5	50.0	90.0	57.7	87.1	56.6	79.1	46.9	68.2	36.9	51.8	23.5	45.9	18.6	64.9	35.5
Cove Fort	42.8	12.8	45.3	17.5	49.7	21.0	59.6	28.6	71.6	36.4	83.4	44.1	92.1	53.2	88.6	51.8	80.0	42.4	69.0	32.5	52.5	20.2	46.0	16.5	65.1	31.4
Fillmore	40.3	18.3	46.4	23.7	53.3	27.8	62.6	36.0	72.9	43.6	84.0	51.7	91.5	60.0	88.8	58.4	80.2	49.3	69.7	39.2	51.1	26.2	43.2	21.2	65.3	38.0
Lund	42.4	12.6	47.0	19.5	55.1	22.5	65.2	30.0	74.6	37.8	86.2	45.9	92.9	52.4	90.0	52.8	81.6	42.2	70.5	33.1	52.5	20.0	46.2	16.0	67.0	32.1
Milford A. P.	40.2	12.9	45.2	19.2	52.6	23.3	62.9	31.3	73.3	39.2	85.6	47.7	93.4	54.6	90.4	54.5	81.1	43.5	69.2	33.6	50.4	20.6	43.9	16.3	65.7	33.1
Modena	42.7	14.3	47.8	20.0	53.6	22.4	63.5	29.2	73.1	36.1	84.7	45.2	91.7	52.5	88.9	52.7	81.0	42.3	70.1	33.7	52.9	21.4	46.7	17.6	66.4	32.3

Source: U. S. Weather Bureau Monthly Climatological Data.

The Basin experiences strong insolation during the day, and rapid nocturnal cooling. This results in a wide range of daily maximum and minimum temperatures, frequently as much as 40° F. The difference between the mean monthly maximum and minimum temperatures for areas below 6,000 feet is 32.4° F. There are cool nights, even during the hottest part of the summer.

Mean annual temperatures for the ten-year base period vary from 51.7° F. at the Fillmore station to 47.4° F. at the Beaver station. Mean monthly maximum and minimum temperatures for selected stations were obtained from National Weather Service monthly Climatological Data (Table 7).

GROWING SEASON

Probable frost-free periods vary from 107 days at Beaver to 156 days at Fillmore (Table 8). Wide variations in growing seasons may occur in the same valley between the bottomland and surrounding benchlands or mouths of adjacent canyons.

WATER SURFACE EVAPORATION

Water surface evaporation values are based on a study described in "Appendix I, Climate, Sevier River Basin, Utah."[1] Average monthly and annual water surface evaporation values for the water budget areas are based on varying periods of record and are adjusted to the 1956-1965 period using available pan evaporation data from the Milford WB station (Table 9). Annual water surface evaporation is shown on the map following page 14. Evaporation data in watersheds with no cultivated land are for valley areas.

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[1] "Appendix I, Climate, Sevier River Basin, Utah," published by the USDA: Economic Research Service, Forest Service and Soil Conservation Service, 1969.

TABLE 8.--Crop growing season, Beaver River Basin, 1956-1965

Watershed		Alfalfa		Spring grain		Field corn		Potatoes		Pasture		Sugar Beets	
		50° Mean Temp.	First 28° Frost	45° Mean Temp	130 Days Growing Season	55° Mean Temp.	120 Days Growing Season	60° Mean Temp	First 32° Frost	45° Mean Temp.	45° Mean Temp.	Last 28° Frost	First 28° Frost
2A FILLMORE													
2A-24	Chalk Creek	4-18	10-23	4-1	8-8	5-5	9-1	5-21	9-28	4-1	10-31		
2A-25	Corn Creek	4-18	10-23	4-1	8-8	5-5	9-1	5-21	9-28	4-1	10-31		
2B BEAVER-MILFORD													
2B-1	Beaver	5-4	9-30	4-15	8-22	5-18	9-14			4-15	10-23		
2B-2	Wildcat Creek	5-4	9-30	4-15	8-22	5-18	9-14			4-15	10-23		
2B-3	Minersville	4-25	10-2	4-9	8-16	5-12	9-8	5-25	9-22	4-9	10-21		
2B-4	Milford	4-24	10-3	4-8	8-15	5-11	9-7	5-24	9-23	4-8	10-22		
2B-5	Cove Creek	5-4	9-24	4-21	8-28					4-21	10-23		
2B1 CEDAR-PAROWAN													
2B1-1	Coal Creek	4-24	10-11	4-6	8-13	5-10	9-6	5-23	9-30	4-6	11-2		
2B1-2	Green's Lake	4-24	10-11	4-6	8-13	5-10	9-6	5-23	9-30	4-6	11-2		
2B1-3	Red Creek	5-3	10-12	4-15	8-22	5-18	9-14	6-4	10-3	4-15	10-22		
2B1-4	Quichapa Creek	4-24	10-11	4-6	8-13	5-10	9-6	5-23	9-30	4-6	11-2		
2B1-5	Rush Lake	4-25	10-2							4-9	10-21		
2B2 ESCALANTE DESERT													
2B2-1	Pinto Creek	5-1	10-9	4-11	8-18	5-18	9-14	6-3	9-29	4-11	11-1	5-4	10-7
2B2-2	Shoal Creek	5-1	10-9	4-11	8-18	5-18	9-14	6-3	9-29	4-11	11-1	5-4	10-7
2B2-3	Beryl	5-1	10-9	4-11	8-18	5-18	9-14	6-3	9-29	4-11	11-1	5-4	10-7
2B2-4	Big Hollow	4-23	10-7	4-6	8-13	5-13	9-9	5-24	9-22	4-6	10-25		

Source: U. S. Weather Bureau annual summaries of climatological data.
Ashcroft, Gaylen L., and Derksen, W. J., "Freezing Temperature Probabilities in Utah," Agricultural Experiment Station, Utah State University, Bulletin 439,1963.
Soil Conservation Service, "Technical Release No. 21, Irrigation Water Requirements," 1967.

TABLE 9.--Water surface evaporation in irrigated areas, Beaver River Basin, 1956-1965[a]

Watershed		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
2-1	Sevier Lake	0.90	1.20	2.90	5.18	7.22	10.25	12.30	9.97	7.49	5.10	3.90	0.85	67.26
2A-19	Tintic	0.55	1.02	2.55	3.65	6.77	8.68	8.86	7.82	5.95	4.02	2.00	0.62	52.49
2A-24	Chalk Creek	0.76	1.25	2.60	3.81	6.26	8.63	8.36	7.91	5.64	4.10	2.70	0.80	52.83
2A-25	Corn Creek	0.76	1.25	2.60	3.81	6.26	8.63	8.36	7.91	5.64	4.10	2.70	0.80	52.83
2B-1	Beaver	0.81	1.26	2.62	4.25	6.41	7.57	8.35	8.29	5.98	4.34	3.13	0.91	53.92
2B-2	Wildcat Creek	0.84	1.31	2.73	4.42	6.67	7.88	8.68	8.62	6.22	4.52	3.25	0.94	56.08
2B-3	Minersville	0.69	1.10	2.77	4.78	6.80	9.02	10.32	10.17	7.68	5.10	3.35	0.80	62.59
2B-4	Milford	0.70	1.12	2.83	4.88	6.94	9.20	10.53	10.38	7.84	5.20	3.42	0.82	63.87
2B-5	Cove Creek	0.80	1.15	2.65	4.54	6.84	8.54	9.25	8.70	6.58	4.30	3.10	0.85	57.29
2B-6	Black Rock	0.80	1.15	2.85	4.86	7.03	9.68	11.61	9.87	7.49	5.10	3.60	0.85	64.89
2B-7	Jacobs Well	0.80	1.15	2.85	4.86	7.03	9.68	11.61	9.87	7.49	5.10	3.60	0.85	64.89
2B1-1	Coal Creek	0.88	1.30	2.65	3.89	5.92	8.63	8.07	7.43	5.73	4.10	3.40	1.00	53.00
2B1-2	Green's Lake	0.88	1.30	2.65	3.89	5.92	8.63	8.07	7.43	5.73	4.10	3.40	1.00	53.00
2B1-3	Red Creek	0.70	1.12	2.83	4.09	6.72	8.40	8.00	7.00	6.04	4.00	3.42	0.82	53.14
2B1-4	Quichapa Creek	0.88	1.30	2.65	3.89	5.92	8.63	8.07	7.43	5.73	4.10	3.40	1.00	53.00
2B1-5	Rush Lake	0.70	1.12	2.75	4.88	6.83	8.92	9.84	9.19	7.03	5.00	3.40	0.82	60.49
2B1-6	Other	0.70	1.12	2.75	4.88	6.83	8.92	9.84	9.19	7.03	5.00	3.40	0.82	60.49
2B2-1	Pinto Creek	0.97	1.35	2.81	4.95	7.47	10.13	9.54	8.35	6.73	5.24	4.56	1.07	63.17
2B2-2	Shoal Creek	1.00	1.40	2.90	5.10	7.70	10.44	9.84	8.61	6.94	5.40	4.70	1.10	65.13
2B2-3	Beryl	0.95	1.23	2.85	5.02	7.60	10.63	10.63	9.19	7.03	5.40	4.40	0.95	65.89
2B2-4	Big Hollow	0.90	1.20	2.85	4.94	7.12	9.87	10.53	9.88	7.40	5.18	3.90	0.90	64.67
2B2-5	Other	0.70	1.12	2.75	4.88	6.83	8.92	9.84	9.19	7.03	5.00	3.40	0.82	60.49

Source: "Appendix I, Climate, Sevier River Basin," U. S. Department of Agriculture, Economic Research Service, Soil Conservation Service, March 1969.

[a]In watersheds without irrigated land, evaporation values are for valley areas.

Chapter III

L A N D   R E S O U R C E S

LAND OWNERSHIP AND ADMINISTRATION

The areas of State, private, Indian, National Monument and public domain lands were determined for each watershed from Bureau of Land Management quadrangle status maps, 1967, at a scale of 1:250,000. National Forest land areas were based on Forest Service status records. Acreages were prorated among all ownerships to agree with the Conservation Needs Inventory (CNI), 1970, watershed acreages (Table 10). These areas were used as they agree with Water Resource Council delineations. The map following page 30 shows land status delineations. Tracts less than one-half square mile in area are not identified.

National Forest lands occupy about 11 percent of the Basin. These lands occupy the high mountain ranges forming a band around the east and south sides of the area. In addition to the National Forest lands identified, there are approximately 51,470 acres of "Other Forested Land" (Table 11). These lands are State, private and public domain and are delineated to clarify planning responsibilities.

Private lands occupy 20 percent of the area. Lands in municipal ownership are included in private land acreages.

State lands occupy 8 percent of the total area. These are generally full sections, commonly four to a township, scattered throughout the Basin.

Over three million acres or 61 percent of the Basin are Public Domain. These lands cover a broad elevational range and differ widely in their characteristics.

Two other ownerships were tabulated: Cedar Breaks National Monument, east of Cedar City, extends into the Basin and occupies about 5,360 acres. A small tract of Indian trust lands east of Kanosh, occupies about 1,600 acres. Figure 4 shows the land status summary and percentage by ownership and administration.

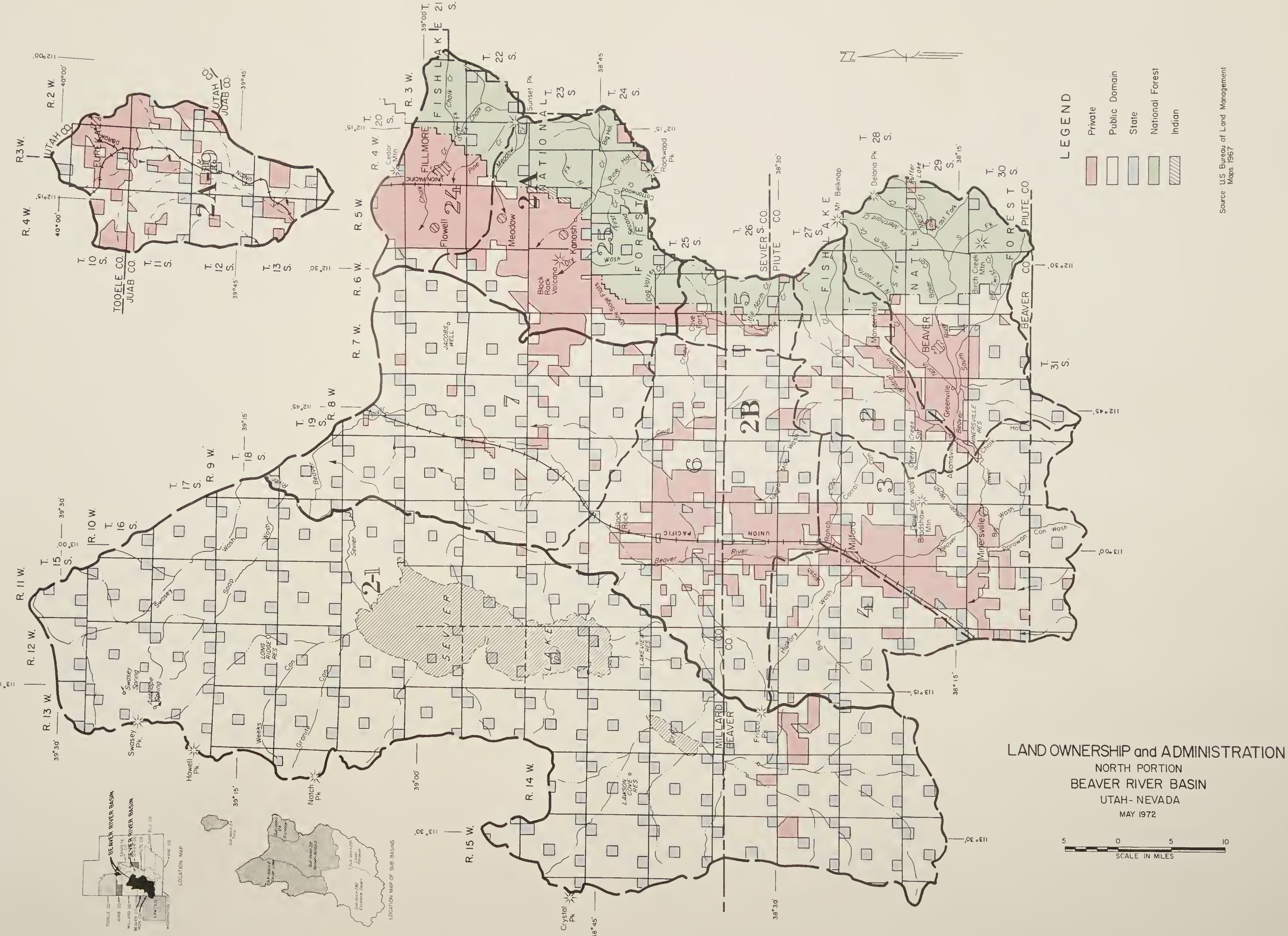
TABLE 10.--Land ownership and administration by county, watershed and subbasin, Beaver River Basin

Hydrologic Unit	County	National Forest	Private	State	Public Domain	Total
		Acres	Acres	Acres	Acres	Acres
Sevier Lake Subbasin						
Sevier Lake (2-1)	Beaver	-	14,060	18,870	169,310	202,240
	Millard	-	-	119,650	823,380	943,030
Watershed total		-	14,060	138,520	992,690	1,145,270
Subbasin total		-	14,060	138,520	992,690	1,145,270
Fillmore Subbasin						
Tintic (2A-19)	Juab	-	43,280	9,840	109,250	162,370
Chalk Creek (2A-24)	Millard	36,220	64,980	3,620	8,350	113,170
	Sevier	2,320	500	-	-	2,820
Watershed total		38,540	65,480	3,620	8,350	115,990
Corn Creek (2A-25)	Millard	102,500	73,180	8,360	26,960	212,600[a]
	Sevier	310	40	250	-	600
Watershed total		102,810	73,220	8,610	26,960	213,200
Subbasin total		141,350	181,980	22,070	144,560	491,560
Beaver-Milford Subbasin						
Beaver (2B-1)	Beaver	96,870	34,900	10,680	62,000	204,450
	Iron	-	80	1,080	4,470	5,630
Watershed total		96,870	34,980	11,760	66,470	210,080
Wildcat Creek (2B-2)	Beaver	21,950	16,290	5,740	69,000	112,980
Minersville (2B-3)	Beaver	-	42,980	20,800	125,190	188,970
	Iron	-	460	340	45,010	45,810
Watershed total		-	43,440	21,140	170,200	234,780
Milford (2B-4)	Beaver	-	16,540	12,380	93,910	122,830
Cove Creek (2B-5)	Beaver	16,600	2,780	800	9,980	30,160
	Millard	9,840	4,570	-	4,770	19,180
	Sevier	400	-	-	-	400
Watershed total		26,840	7,350	800	14,750	49,740
Black Rock (2B-6)	Beaver	-	34,430	9,760	104,170	148,360
	Millard	-	41,840	22,070	129,110	193,020
Watershed total		-	76,270	31,830	233,280	341,380
Jacobs Well (2B-7)	Millard	-	14,140	26,110	341,600	381,850
Subbasin total		145,660	209,010	109,760	989,210	1,453,640
Cedar-Parowan Subbasin						
Coal Creek (2B1-1)	Iron	34,630	107,050	7,200	47,020	201,260[b]
Greens Lake (2B1-2)	Iron	-	4,560	80	1,600	6,240
Red Creek (2B1-3)	Beaver	2,990	350	1,010	4,500	8,850
	Garfield	930	1,060	-	2,440	4,430
	Iron	35,160	71,380	10,000	119,960	236,500
Watershed total		39,080	72,790	11,010	126,900	249,780
Quichapa Creek (2B1-4)	Iron	2,060	56,620	3,320	40,130	102,130
Rush Lake (2B1-5)	Iron	-	10,040	9,800	104,640	124,480
Other (2B1-6)	Iron	-	-	1,270	9,730	11,000
Subbasin total		75,770	251,060	32,680	330,020	694,890
Escalante Desert Subbasin						
Pinto Creek (2B2-1)	Iron	21,400	38,870	6,790	31,660	98,720
	Washington	63,000	3,910	710	580	68,200
Watershed total		84,400	42,780	7,500	32,240	166,920
Shoal Creek (2B2-2)	Iron	31,050	9,640	650	4,920	46,260
	Washington	77,480	10,280	840	4,880	93,480
(Nevada)	Lincoln	-	-	-	2,180	2,180
Watershed total		108,530	19,920	1,490	11,980	141,920
Beryl (2B2-3)	Beaver	-	-	1,400	6,840	8,240
	Iron	5,850	192,860	43,450	317,320	559,480
(Nevada)	Lincoln	-	-	-	67,480	67,480
Watershed total		5,850	192,860	44,850	391,640	635,200
Big Hollow (2B2-4)	Beaver	-	11,360	16,920	118,070	146,350
	Iron	1,870	143,600	26,970	185,060	357,500
Watershed total		1,870	154,960	43,890	303,130	503,850
Other (2B2-5)	Iron	-	150	1,740	7,110	9,000
Subbasin total		200,650	410,670	99,470	746,100	1,456,890
BEAVER RIVER BASIN TOTAL		563,430	1,066,780	402,500	3,202,580	5,242,250[c]

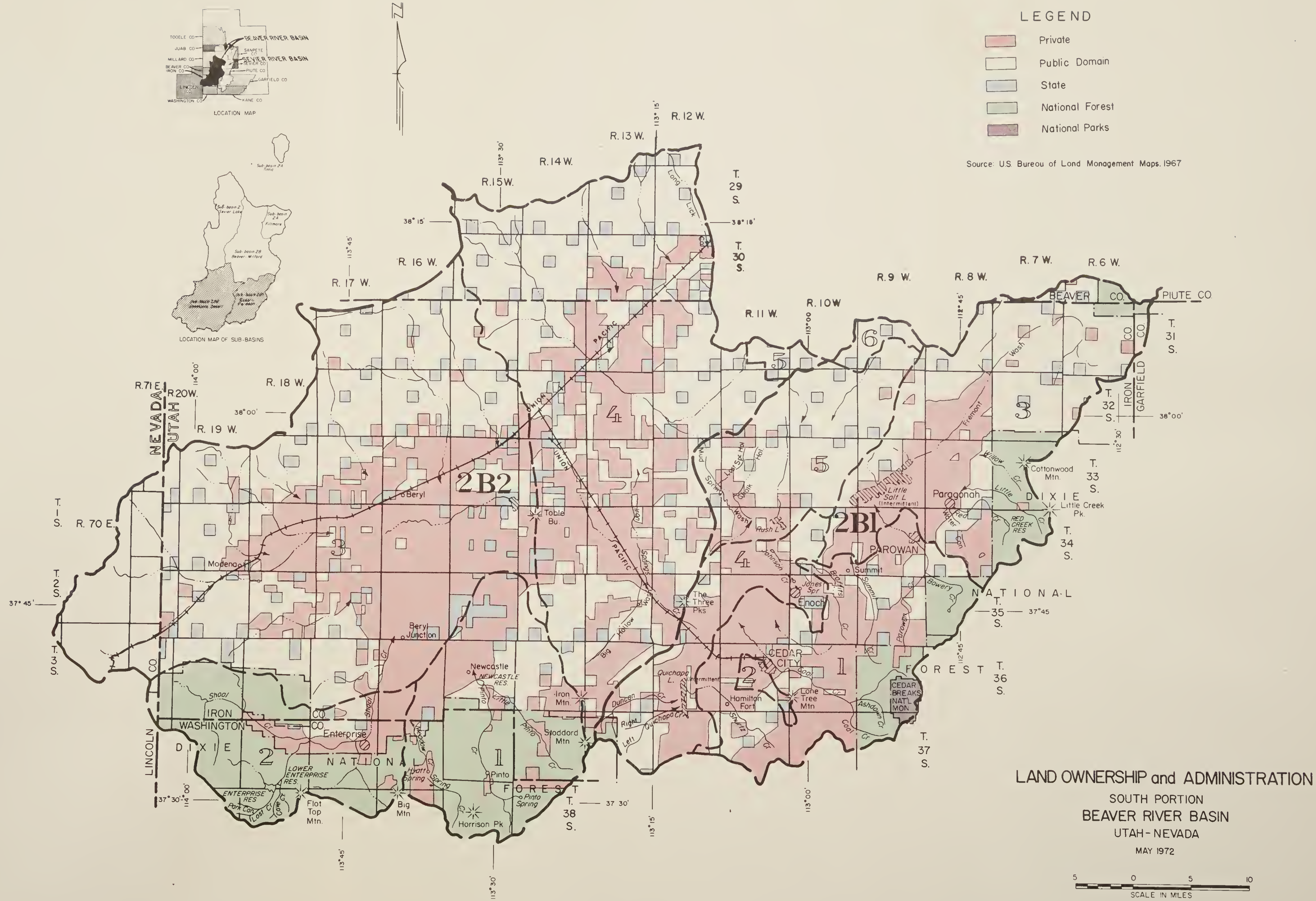
[a]Contains 1,600 acres of Indian Trust lands which are included in watershed, subbasin and Beaver River Basin totals.

[b]Contains 5,360 acres of Cedar Breaks National Monument included in watershed, subbasin and Beaver River Basin totals.

[c]Contains acreages explained above in footnotes a and b.



LAND OWNERSHIP and ADMINISTRATION
NORTH PORTION
BEAVER RIVER BASIN
UTAH - NEVADA
MAY 1972
LEGEND
Private
Public Domain
State
National Forest
Indian
Source: U.S. Bureau of Land Management Maps, 1967
SCALE IN MILES
5 0 5 10
FISHLAKE NATIONAL FOREST
SEVIER LAKE
Milford
Minersville
Beaver
Fillmore
Kanosh
Meadow
Flowell
Greenville
Adamsville
Eureka
LOCATION MAP
LOCATION MAP OF SUB BASINS



LAND OWNERSHIP and ADMINISTRATION
SOUTH PORTION
BEAVER RIVER BASIN
UTAH-NEVADA
MAY 1972

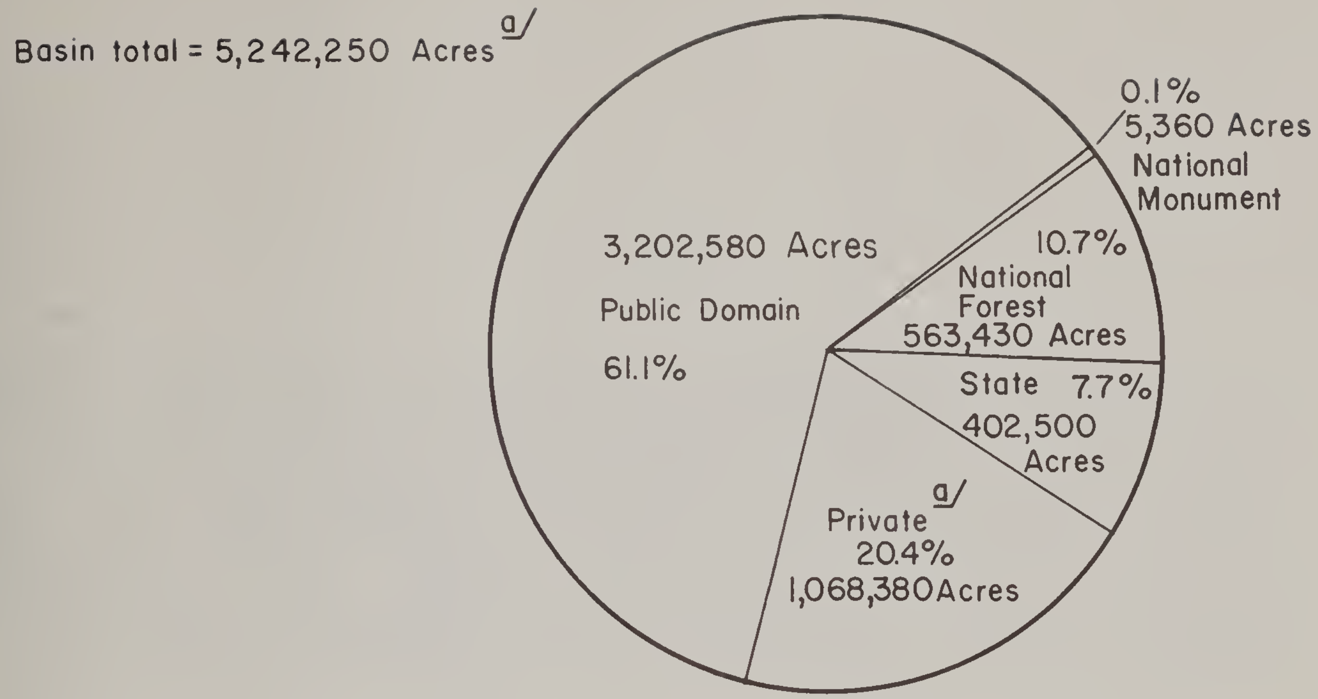


Figure 4: Land ownership and administration, Beaver River Basin

a/ Includes 1,600 acres of Indian Trust lands.

Table 11.--Areas of forested lands other than National Forests, Beaver River Basin

Watershed		Within N.F. Boundaries State	Within N.F. Boundaries Private	Outside N.F. Boundaries State, private & public domain	Total
		(Acres)	(Acres)	(Acres)	(Acres)
2A-24	Chalk Creek	2,040	710	None	2,750
2A-25	Corn Creek	5,180	1,390	None	6,570
2A	Fillmore	7,220	2,100		9,320
2B-1	Beaver	4,660	240	None	4,900
2B-2	Wildcat Cr.	10	260	None	270
2B-5	Cove Creek	640	580	None	1,220
2B	Beaver-Milford	5,310	1,080		6,390
2B1-1	Coal Creek	1,970	2,120	24,430	28,520
2B1-3	Red Creek	50	2,510	4,150	6,710
2B1-2	Greens Lake			530	530
2B1	Cedar-Parowan	2,020	4,630	29,110	35,760
Basin Total		14,550	7,810	29,110	51,470

SOILS

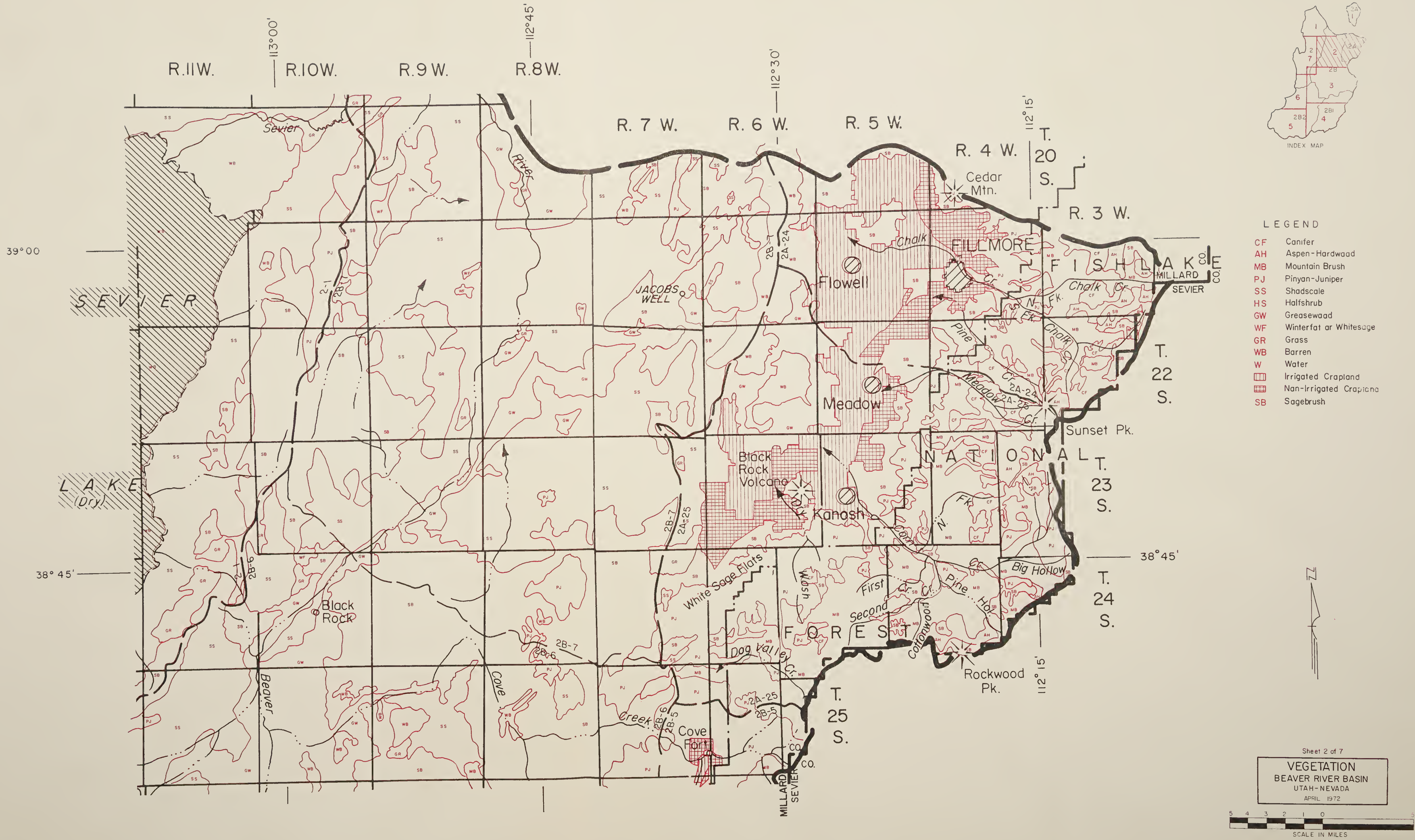
Soils Association descriptions are described in a supplement to this appendix. Maps were prepared using existing survey data, on-site observations and personal knowledge of the area. Mapping units are composed of one or more soils comprising a soil association and may contain undifferentiated soil units and miscellaneous land types. The generalized descriptions include parent material, texture, aspect, erosion, slope, elevation, precipitation, vegetal cover, water-holding capacity, drainage, cropland and range site capability class, and salinity.

NATIVE VEGETATION

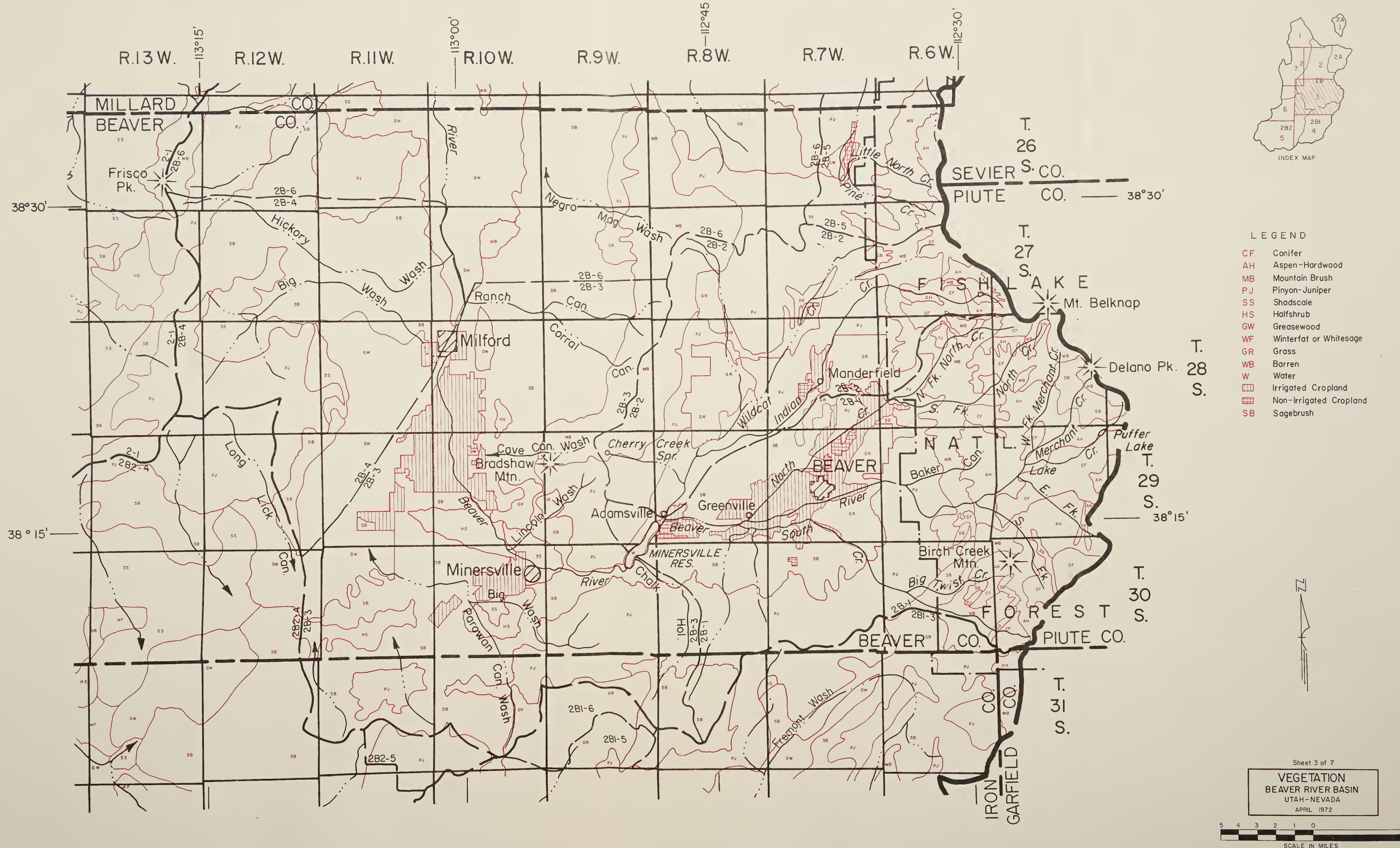
Native vegetation was mapped into ten types with barren and cropland areas excluded. Information was obtained from National Forest Timber Inventory Maps and Bureau of Land Management range reconnaissance mapping for the majority of the area. Small areas within private ownership and other areas not included were field mapped in the summer of 1968 or extrapolated from adjacent areas. Field work on which the Bureau of Land Management and Forest Service maps are based was accomplished from the 1940's to early 1960's. The area of each vegetative type was determined by planimetering (Table 12).

The ten vegetative types are conifer, aspen, mountain brush, pinyon-juniper, sagebrush, shadscale, half-shrub, greasewood, winterfat and grass. This listing roughly follows from higher elevations to the valley floors and from abundant to scant precipitation. Other land areas not described include croplands, wet meadows and small patches of native vegetation. Barren areas included desert playas, recent extrusions of volcanic basalt, and areas covered predominantly with annual weeds such as pickleweed (Allenrolfea occidentalis) or gray molly (Kochia trichophyllia). On the higher flanks of the Tushar Mountains, an area of rock was also included in the barren classification. Vegetative types are delineated on the maps following page 32.


R. 13 W.
R. 12 W.
R. 11 W.
R. 10 W.
R. 9 W.
R. 8 W.
T. 15 S.
T. 16 S.
T. 17 S.
T. 18 S.
T. 19 S.
39°30'
39°15'
113°15'
113°00'
112°45'
Swasey Pk.
Howell Pk.
Notch Pk.
Swasey Spring
Antelope Spring
Swasey Wash
Soap Wash
Weeks Can.
Granite Can.
LONG RIDGE RES.
Sevier River
Beaver River
R. 4 W.
R. 3 W.
R. 2 W.
T. 10 S.
T. 11 S.
T. 12 S.
T. 13 S.
112°15'
40°00'
39°45'
EUREKA
TOOELE CO.
JUAB CO.
UTAH CO.
UTAH
JUAB CO
2A-19
INDEX MAP
LEGEND
CF Conifer
AH Aspen-Hardwood
MB Mountain Brush
PJ Pinyon-Juniper
SS Shadscale
HS Halfshrub
GW Greasewood
WF Winterfat or Whitesage
GR Grass
WB Barren
W Water
Irrigated Cropland
Non-Irrigated Cropland
SB Sagebrush
N
Sheet 1 of 7
VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972
5 4 3 2 1 0 5
SCALE IN MILES



R.11W.
R.10W.
R.9W.
R.8W.
R. 7 W.
R. 6 W.
R. 5 W.
R. 4 W.
R. 3 W.
T. 20 S.
T. 22 S.
T. 23 S.
T. 24 S.
T. 25 S.
113°00'
112°45'
112°30'
112°15'
39°00
38°45'
SEVIER LAKE (Dry)
Sevier River
JACOBS WELL
Flowell
FILLMORE
Meadow
Black Rock Volcano
Kanosh
Black Rock
Cove Fort
Cedar Mtn.
Sunset Pk.
Rockwood Pk.
FISHLAKE NATIONAL FOREST
Chalk Cr.
Pine Cr.
Meadow Cr.
Corn Cr.
Big Hollow
First Cr.
Second Cr.
Cottonwood Cr.
White Sage Flats
Wash
Dog Valley Cr.
Cove Creek
Beaver
MILLARD CO.
SEVIER CO.
INDEX MAP
LEGEND
CF Conifer
AH Aspen-Hardwood
MB Mountain Brush
PJ Pinyan-Juniper
SS Shadscale
HS Halfshrub
GW Greasewood
WF Winterfat or Whitesage
GR Grass
WB Barren
W Water
Irrigated Cropland
Non-Irrigated Cropland
SB Sagebrush
Sheet 2 of 7
VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972
SCALE IN MILES

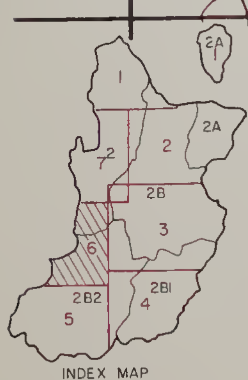


R.13W.
R.12W.
R.11W.
R.10W.
R.9W.
R.8W.
R.7W.
R.6W.
113°15'
113°00'
112°45
112°30'
38°30'
38°15'
T. 26 S.
T. 27 S.
T. 28 S.
T. 29 S.
T. 30 S.
T. 31 S.
MILLARD CO.
BEAVER CO.
SEVIER CO.
PIUTE CO.
IRON CO.
GARFIELD CO.
FISHLAKE NAT'L. FOREST
Frisco Pk.
Milford
Minersville
MINERSVILLE RES.
Adamsville
Greenville
BEAVER
Manderfield
Bradshaw Mtn.
Birch Creek Mtn.
Mt. Belknap
Delano Pk.
Puffer Lake
Cherry Creek Spr.
Hickory Wash
Big Wash
Negro Mag Wash
Ranch Can.
Corral Can.
Cave Can. Wash
Lincoln Wash
Long Lick Can.
Big Wash
Parowan Can. Wash
Fremont Wash
Hol.
Chalk Cr.
Beaver River
Wildcat
Indian Cr.
North Cr.
South Cr.
N. Fk. North Cr.
S. Fk.
Baker Can.
W. Fk. Merchant Cr.
Merchant Lake Cr.
E. Fk.
S. Fk.
Big Twist Cr.
Little North Cr.
Pine Cr.
2-1
2B-6
2B-4
2B-5
2B-2
2B-3
2B2-4
2B1-3
2B1-5
2B1-6
2B2-5
INDEX MAP
LEGEND
CF Conifer
AH Aspen-Hardwood
MB Mountain Brush
PJ Pinyon-Juniper
SS Shadscale
HS Halfshrub
GW Greasewood
WF Winterfat or Whitesage
GR Grass
WB Barren
W Water
Irrigated Cropland
Non-Irrigated Cropland
SB Sagebrush
N
Sheet 3 of 7
VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972
5 4 3 2 1 0 5
SCALE IN MILES

Sheet 4 of 7

VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972


NEVADA
UTAH
LINCOLN CO.
114° 00'
113° 45'
113° 30'
R. 19 W.
R.18 W.
R.17 W.
R.16 W.
R.15 W.
R.14 W.
T. 1 S.
R. 70 E.
T. 2 S.
T. 3 S.
37°45'
T 33 S
T 34 S
T 35 S
T 36 S
T 37 S
Beryl
Modena
Table Bu.
Dick Palmer Wash
Beryl Junction
Newcastle
NEWCASTLE RES.
Iron Mtn.
Shoal Cr.
Pinto Cr.
Little Pinto Cr.
Stoddard Mtn.
IRON CO.
WASHINGTON CO.
Enterprise
Meadow Cr.
DIXIE NATIONAL FOREST
LOWER ENTERPRISE RES.
ENTERPRISE RES.
Park Can.
Lost Cr.
Cave Cr.
Flat Top Mtn.
Hyatt Spring
Spring Cr.
Big Mtn.
Pinto
Pinto Spring
Harrison Pk.
37° 30'
2B2-3
2B2-4
2B2-2
2B2-1
INDEX MAP
LEGEND
CF Conifer
AH Aspen-Hardwood
MB Mountain Brush
PJ Pinyon-Juniper
SS Shadscale
HS Halfshrub
GW Greasewood
WF Winterfat or Whitesage
GR Grass
WB Barren
W Water
Irrigated Cropland
Non-Irrigated Cropland
SB Sagebrush
N
Sheet 5 of 7
VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972
5 4 3 2 1 0 5
SCALE IN MILES



LEGEND

WF	Winterfat or Whitesage	CF	Conifer
GR	Grass	AH	Aspen-Hardwood
WB	Barren	MB	Mountain Brush
W	Water	PJ	Pinyon-Juniper
	Irrigated Cropland	SS	Shadscale
	Non-Irrigated Cropland	HS	Halfshrub
SB	Sagebrush	GW	Greasewood

Sheet 6 of 7

VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972

5 4 3 2 1 0 5
SCALE IN MILES

R.13W.
R.12W.
R. 15 W.
R. 14 W.
39°00'
113°30'
38° 30'
T 21 S
T 22 S
T 23 S
T 24 S
T 25 S
T 26 S
N
SEVIER
LAKE
(Dry)
Crystal Pk.
LAWSON COVE RES.
LAKEVIEW RES.
(Dry)
2-1
2B-6
MILLARD CO.
BEAVER CO.
Frisco Pk.
INDEX MAP
LEGEND
WF Winterfat or Whitesage
GR Grass
WB Barren
W Water
Irrigated Cropland
Non-Irrigated Cropland
SB Sagebrush
CF Conifer
AH Aspen-Hardwood
MB Mountain Brush
PJ Pinyan-Juniper
SS Shadscale
HS Halfshrub
GW Greasewood
Sheet 7 of 7
VEGETATION
BEAVER RIVER BASIN
UTAH-NEVADA
APRIL 1972
5 4 3 2 1 0 5
SCALE IN MILES

Table 12.--Area of ten vegetative types by subbasin within the Beaver River Basin

Vegetative types	(2A) Fillmore	(2B) Beaver-Milford	(2B1) Cedar-Parowan	(2B2) Escalante Desert	(2) Sevier Lake	Total
	Acres	Acres	Acres	Acres	Acres	Acres
Conifer	15,380	43,560	33,450	2,240	-	94,630
Aspen-Hardwood	10,760	33,860	28,620	-	-	73,240
Mountain brush	81,930	92,450	68,810	47,050	19,470	309,710
Pinyon-juniper	127,130	272,620	195,580	502,600	210,620	1,308,550
Sagebrush	106,340	443,560	190,640	438,770	131,710	1,311,020
Shadscale	22,770	266,580	570	126,150	519,950	936,020
Half-shrub	-	45,290	21,200	102,730	150,030	319,250
Greasewood	17,380	138,700	68,500	106,410	-	330,990
Winterfat	-	2,740	2,530	21,050	-	26,320
Grass	13,640	57,190	31,080	61,610	14,890	178,410
Sub-total	395,330	1,396,550	640,980	1,408,610	1,046,670	4,888,140
Barren	25,100	18,060	6,780	10,070	98,490	158,500
Cropland	71,130	39,030	47,130	38,210	110	195,610
Total	491,560	1,453,640	694,890	1,456,890	1,145,270	5,242,250

CONIFER

Conifer vegetation occupies mountain slopes where annual precipitation ranges from 25 to 40 inches. Elevations are commonly above 8,500 feet. Soils are variable but typically are gray wooded soils characterized by medium acid A2 horizons and strongly acid B2 horizons. Conifer is located in scattered patches at high elevations of the Pavant Plateau, south along the Tushar Mountains, the west edge of the Markagunt Plateau, and a few small patches on the Mineral Mountains and Swasey Peak in the House Range. The Beaver Watershed contains 37,060 acres and the Coal Creek Watershed, 24,290 acres or 65 percent of the conifer within the Basin.

Alpine forests occupy the higher elevational zones with Engelmann spruce (Picea engelmannii) and Subalpine fir (Abies lasiocarpa) predominating. Douglas fir (Pseaudotsuga menziesii), generally found on northern slopes at lower elevations, and with ponderosa pine (Pinus ponderosa), together characterize a montane forest. Other limited areas of conifer include limber pine (Pinus flexilis), blue spruce (Picea pungens) and white fir (Abies concolor).

ASPEN

Aspen occupies the same elevational zone and precipitation ranges as conifers and are usually intermixed with them. Soils are typically deep brown, cool prairie like, with high fertility and water-holding capacity. Aspen is found on the eastern-most edge of the Basin extending south from the Pavant Plateau across the Tushar Mountains to the Markagunt Plateau. There are 73,240 acres of aspen with 29,150 acres of this amount in the Beaver Watershed and 26,510 acres in the Coal Creek Watershed. These two watersheds contain 76 percent of the aspen area. The characteristic species is quaking aspen (Populus tremuloides) with typical understory vegetation.

MOUNTAIN BRUSH

Mountain brush is located on steep slopes, sometimes occurring as understory with montane forest or aspen species. Annual precipitation ranges from 18 to 25 inches and elevations are usually above 7,000 feet. Soils are similar to those under aspen; usually deep, well drained, highly fertile with excellent water-holding capacities. Extensive areas of mountain brush occur on the Pavant Plateau, Tushar Mountains, Markagunt Plateau, Pine Valley Mountains, Swasey Peak and Mineral Mountains; and in small patches at other high elevation locations. Mountain brush covers 309,710 acres or 6 percent of the total Basin area.

Common species of mountain brush include oak (Quercus gambelii), snowberry (Symphoricarpos spp.), serviceberry (Amelanchier alnifolia), rabbitbrush (Chrysothamnus spp.), bitterbrush (Purshia tridentata), maple (Acer glabrum), saltbrush (Atriplex canescens), and big sagebrush (Artemisia tridentata). Less common species include mountain-mahogany (Cercocarpos ledifolius), cliffrose (Cowania stansburiana) and chokecherry (Prunus virginiana).

PINYON-JUNIPER

Pinyon pine (Pinus edulis)(Pinus monophylla) and juniper (Juniperous osteosperma) cover over 1.3 million acres or 25 percent of the area. Over one-third of the pinyon-juniper acreage is within the Escalante Desert subbasin. Annual precipitation ranges from 10 to 20 inches. This vegetative type is prevalent in shallow rocky soils. Because of control of wildfires and domestic livestock grazing, many authorities believe that pinyon-juniper now occupies many acres which once grew bunchgrasses and sagebrush.

SAGEBRUSH

Sagebrush occupies an area about equal to that growing pinyon-juniper. It is found at every elevation and precipitation range and big sage often occupies deep, well drained soils that are relatively salt free. Sagebrush species and subspecies include silver sage (Artemisia cana), black sage (Artemisia nova), bud sage (Artemisia spinescens), three tip sage (Artemisia trifida) low sage (Artemisia arbuscula), and the most common, big sage (Artemisia tridentata).

SHADSCALE

Shadscale is found at elevations less than 5,000 feet and where annual precipitation is less than 10 inches. Surface soil horizons are often slightly alkaline and rapidly grade to strongly alkaline sub-soils. The Sevier Lake subbasin contains 519,950 acres or over one-half the 936,020 acres of shadscale. This vegetative type grows on 18 percent of the total area.

Shadscale is named for the atriplex species which characterize the type. The most common of these species are shadscale (Atriplex confertifolia) and some saltbush (Atriplex canescens).

HALF SHRUB

This vegetation is dominant on six percent of the Basin area with about one-half of its total area located in the Sevier Lake subbasin. It is found where annual precipitation is less than eight inches and soils typically contain a hard pan or clay pan. It is characterized by semi-woody perennials of low stature such as Aplopappus, fringed sagebrush (Artemisia frigida), buckwheat (Eriogonum Wrightii) and horsebrush (Tetradymia spinescens). These species are all found as components of other vegetative types in the semidesert area.

GREASEWOOD

Greasewood (Sarcobatus vermiculatus) is often found in almost pure stands. It is absent in the Sevier Lake subbasin, but found in all other subbasins. It covers six percent of the Basin area. Greasewood is found where annual precipitation is less than 10 inches, and in areas of water inflow where salts accumulate and soils have a high clay content.

WINTERFAT

Winterfat (Erotia lanata) is the identifying species and is dominant on less than one percent or 26,320 acres of the Basin area. Of this amount, 21,060 acres or 81 percent is found in the Escalante Desert subbasin. Winterfat grows where soils are fine textured, silty, and somewhat well drained. It occurs where precipitation is below 8 inches annually. Because of the importance of these areas for winter grazing, they were delineated although they are limited in extent.

GRASS

Areas of grassland comprise 178,410 acres or three percent of the total Basin acreage. Much of this area is not true "native vegetation" as it has been established by removing existing native vegetation and reseeding grasses such as ryegrass (Lolium species) or crested wheat (Agropyron cristatum).

FOREST RESOURCES

Commercial forest resources are defined as "forest that is capable of producing industrial wood." The amount of commercial forest by area, species, and land ownerships in the seven watersheds containing commercial forests were tabulated (Table 13). Quantities indicate the total resource without consideration of access, log-ability, markets, other uses, and special use withdrawals, such as Cedar Breaks National Monument.

Sawtimber is found on 110,410 acres; 38 percent in the Beaver watershed. The total volume of sawtimber is about 663 million board feet; 40 percent within Beaver watershed. Coal Creek watershed contains the most aspen by volume of sawtimber and Beaver watershed contains the greatest acreage. Engelmann spruce and ponderosa pine are the higher value species with aspen lowest in value. There is a considerable quantity of pole sized aspen, but conifer species are mostly in mature stands.

The principle noncommercial forest species are pinyon-juniper covering about 1,308,550 acres. One study[1] estimates that these stands contain 169.14 cubic feet of wood per acre. This would result in a resource of about 222 million cubic feet that is presently very lightly utilized.

FORAGE RESOURCES

Livestock use of the forage resource is described in Appendix II, "Present and Projected Resource Use and Management." The total Basin area, exclusive of barren land and cropland, encompasses 4,888,140 acres, and of this amount 4,207,810 acres are suitable for grazing by domestic livestock. Rangelands vary in their productivity according to precipitation or available moisture and soil conditions. About 10.7 acres per AUM is the average carrying capacity. The vegetative species composition of rangeland is also extremely variable because of widely ranging elevation, climate conditions,and growing factors.

[1]"Forests in Utah" by Grover A. Choate, Intermountain Forest and Range Experiment Station, U.S.D.A., Ogden, Utah.

TABLE 13.--Commercial forest resources of the Beaver River Basin, 1965[a]

Species	Acreage by Size			Volume (MBM)[b]	
	Sawtimber	Poles	Seedling & Sapling	Sawtimber	Poles
2A-24 Chalk Creek					
Douglas fir	4,160	1,110	-	24,830	950
White fir	1,940	420	-	10,530	120
Sub-alpine fir	200	40	-	1,030	50
Quaking aspen	2,250	810	1,190	8,520	320
Sub-Total	8,550	2,380	1,190	44,910	1,440
2A-25 Corn Creek					
Douglas fir	1,800	570	-	10,730	490
White fir	4,120	310	-	22,420	80
Sub-alpine fir	250	50	-	1,320	70
Engleman spruce	540	-	-	4,650	-
Quaking aspen	3,240	3,370	-	12,290	1,330
Sub-Total	9,950	4,300	-	51,410	1,970
2B-1 Beaver					
Douglas fir	6,300	-	-	39,040	-
Ponderosa pine	1,460	390	-	5,430	100
White fir	6,270	780	-	35,720	210
Sub-alpine fir	3,790	1,400	-	19,930	1,880
Engleman spruce	14,670	2,000	-	127,470	920
Quaking aspen	9,330	17,780	2,040	38,460	7,110
Sub-Total	41,820	22,350	2,040	266,050	10,220
2B-2 Wildcat Creek					
Douglas fir	1,020	180	-	6,150	150
Ponderosa pine	110	30	-	400	10
White fir	730	100	-	4,040	30
Sub-alpine fir	470	130	-	2,490	170
Engleman spruce	1,730	110	-	15,060	50
Quaking aspen	1,300	1,240	350	5,080	490
Sub-Total	5,360	1,790	350	33,220	900
2B-5 Cove Creek					
Douglas fir	1,360	240	-	8,250	210
White fir	400	50	-	2,210	10
Quaking aspen	880	840	230	3,420	330
Sub-Total	2,640	1,130	230	13,880	550
2B1-1 Coal Creek					
Douglas fir	4,540	800	-	27,420	690
Ponderosa pine	1,540	410	-	5,690	110
White fir	2,140	290	-	11,820	80
Sub-alpine fir	2,300	610	-	12,110	820
Engleman spruce	10,960	700	-	95,220	320
Quaking aspen	11,930	11,400	3,180	46,580	4,520
Sub-Total	33,410	14,210	3,180	198,840	6,540
2B1-3 Red Creek					
Douglas fir	2,240	400	-	13,520	340
Ponderosa pine	760	200	-	2,830	60
White fir	1,160	160	-	6,410	20
Sub-alpine	620	170	-	3,280	220
Engleman spruce	2,890	180	-	25,100	80
Quaking aspen	1,010	960	270	3,930	380
Sub-Total	8,680	2,070	270	55,070	1,100
Basin					
Douglas fir	21,430	3,290	-	129,940	2,810
Ponderosa pine	3,870	1,030	-	14,350	280
White fir	16,750	2,110	-	93,130	550
Sub-alpine fir	7,630	2,400	-	40,160	3,210
Engleman spruce	30,800	3,000	-	267,510	1,380
Quaking aspen	29,930	36,400	7,260	118,290	14,490
Total	110,410	48,230	7,260	663,380	22,720

[a]Forest that is capable of producing industrial wood - the total resource without regard to access, logability, merchantibility, multiple use considerations, or that withdrawn from timber utilization.

[b]Thousand feet board measure.

MINERAL RESOURCES

The variety of mineral resources was noted by early explorers. Coal in Coal Creek Canyon and other areas of eastern Iron County was noted by Fremont and others who traversed the "Old Spanish Trail" prior to 1850. The earliest recorded development of mineral resources in the State was the opening of the Leyson Mine in Coal Creek Canyon in 1854.

Soon after colonization of the Parowan-Cedar City area in 1851, large bodies of pegmatite, muscovite, hornblende, hematite and magnetite were found or tentatively located west of Cedar City and in the Beaver Lake Mountains near Milford. Some quantities of gold, silver, copper, lead, and zinc were found principally in the Frisco Mountains and Tushar Mountains. Coal was used to make coke and crude blast furnaces were built at "Old Irontown" west of Cedar City.

Minerals of commercial value presently include gold, silver, copper, lead, and zinc. These are located in the Mineral Range, Tushar Mountains, Frisco Mountains and Beaver Lake Mountains. West of Cedar City a large body of iron ore is being developed. Pumice is found in scoria deposits near Fillmore and Flowell.

Low grade coal fields are extensive in the Markagunt Plateau, Pine Valley Mountains and near Parowan Gap. Gem stones such as agate and petrified wood are found principally in the House Range.

Prospecting is active on uranium claims in the foothills of the Tushar Mountains east of Beaver. There are many abandoned mines and claims north of Lund and in the vicinity of Modena.

The entire Beaver River Basin is highly mineralized. However, present low levels of production are due to economic factors and low mineral concentrations.

Chapter IV

WATER RESOURCES

Most of the water resources originate within the Basin although some are imported. The 1956-1965 average annual precipitation volume orginating within the Basin is estimated to be 4,650,430 acre-feet (Table 4). Precipitation in the upper watershed areas in excess of on-site consumptive use reaches the valley areas by surface and subsurface flows and contributes to ground water reservoirs and surface irrigation supplies. Quality of surface and subsurface water supplies vary considerably.

QUANTITY

Average annual outflow from the Basin is about 13,000 - 16,000 acre-feet. This leaves the Basin as ground water to the Kannaraville area and Clear Lake Springs. Minor amounts of surplus water in the lower reaches of Beaver River Valley contribute to the ground water supply which in turn tends to move toward Sevier Lake. Surface water is imported from Grass Valley on the upper reach of the Santa Clara River to Pinto Creek in the Escalante Desert subbasin, and from the Sevier River to the Fillmore subbasin via the Utah Central Canal. About 6,000 - 7,000 acre-feet of ground-water inflow comes from the Markagunt Plateau.

SURFACE WATER

Water yield determinations were made using three sources of data: (1) yield maps prepared by the Utah Agricultural Experiment Station in cooperation with the Division of Water Resources (Utah Water and Power Board) and Utah State Engineer, (2) yield maps prepared by the U.S. Forest Service, and (3) streamflow measurements.

Streamflows have been recorded by the U.S. Geological Survey for the Beaver River since 1906 and for Coal Creek since 1915 and are continuous since 1914 and 1938, respectively. Streamflow records collected by the U. S. Geological Survey are shown in Table 14.

Table 14.--Summary of Geological Survey stream gaging records, Beaver River Basin[a]

Station No.	Station Name	Period of Continuous Record
10-2325	Chalk Creek near Fillmore, Utah	1944-present
10-2330	Meadow Creek near Meadow, Utah	1965-present
10-2335	Corn Creek near Kanosh, Utah	1965-present
10-2340	Three Creeks near Beaver, Utah	1947-1961
10-2345	Beaver River near Beaver, Utah	1914-present
10-2350	South Creek near Beaver, Utah	1965-present
10-2360	North Fork North Creek near Beaver, Utah	1965-present
10-2365	South Fork North Creek near Beaver, Utah	1965-present
10-2370	Beaver River at Adamsville, Utah	1914-present[b]
10-2375	Indian Creek near Beaver, Utah	1947-1949 1965-present
10-2385	Minersville Reservoir near Minersville, Utah	1938-present
10-2390	Beaver River at Rocky Ford Dam, near Minersville, Utah	1914-1936 1938-present
10-2414	Little Creek near Paragonah, Utah	1959-present
10-2414.3	Red Creek near Paragonah, Utah	1965-present
244	Center Creek near Parowan, Utah	1943-1950
10-2416	Summit Creek near Summit, Utah	1964-present
10-2420	Coal Creek near Cedar City, Utah	1938-present
9-4085	Santa Clara-Pinto diversion near Pinto, Utah	1953-1962
10-2424.3	Grassy Creek near Enterprise, Utah	1964-1968

[a]Does not include stations with intermittent records or crest-stage partial-record stations.

[b]Records for October 1937 to October 1938 were estimated.

Streamflow measurements were made on selected ungaged streams during the 1963-1970 period. These measurements were made periodically to determine base flow, snowmelt flow and changing seasonal conditions (Table 15).

Figure 5 shows probable annual flow for Chalk Creek, Beaver River, and Coal Creek for the 1956-1965 base and long-term periods. Generally, the base period record produces the higher flow at the one percent event. Monthly and annual flow volumes at the above selected stations for the one, ten and fifty percent chance events using the long-term record and the 1956-1965 period as the basis of distribution were computed (Table 16 and 17). Log-Pearson type III distribution was used to rank monthly and annual (calendar year) flow volumes for Coal Creek, Chalk Creek, and the Beaver River.

In the Cedar-Parowan subbasin, Geological Survey records were used to correlate annual flow volumes of the smaller streams with Coal Creek. Most records have only been maintained since 1964 so the available data were sketchy, but the resulting plots appeared reasonable. The correlated data were expanded to include the 1956-1965 base period (Table 18).

Yield maps prepared by Utah Agricultural Experiment Station and the Forest Service were made by an interpretive correlation of rainfall patterns, soil types, cover complexes, land topography, and available gaged records. Lines of yield on the maps are average annual values, even though varying lengths of gaged records were used. Correlations between gaged flows and the yield maps made during the Sevier River Basin studies indicated the Forest Service yield maps gave the most consistent results. Water budgets for the Beaver River Basin support these findings. However, these maps provide relative values only and are more accurate for larger streams than smaller drainages.

Watershed yield volumes were determined from each set of maps for comparison (Table 19). Actual conditions were more closely simulated by the addition of a 0.1 inch yield line to the Forest Service maps. This line generally followed the 6,000 foot contour. Annual water yield is shown on the map following page 14.

The yield by water budget area is shown in Table 20. Correlation factors are included to show the adjustment of yield determined from the Forest Service map to that used in the water-budget analysis for the 1956-1965 period. Correlation factors and yields are for the "average" annual condition within the base period.

TABLE 15.--Selected stream flow measurements, Beaver River Basin

Watershed	Stream or drainage	Location[a]	Date of measurement	Time of measurement[b]	Discharge cfs	Remarks
2A-25 Corn Creek	Corn Creek	T23S,R5W	4-22-65	1600	56.3	
			5-13-65	1500	40.1	
			6-4-65	1430	53.4	
	Meadow Creek	T22S,R4W	4-22-65	1700	22.7	All measurements above diversion
			5-13-65	1630	23.0	
			6-4-65	1530	37.8	
			9-8-65	1320	3.7	
2B-2 Wildcat Creek	Cherry Creek	T29S,R9W	5-5-66	1245	0.1	At Pass Canyon Road
			-	1150	0.1	
			8-23-66	1645	0.05	At Pass Canyon Road
			10-6-66	1100	0.04	At Pass Canyon Road
			11-21-66	1300	0.06	At Pass Canyon Road
			2-20-67	1255	0.06	
			5-9-68	1210	0.87	0.5 miles below spring area
			5-29-68	1045	0.4	
			6-4-69	1415	0.6	5 miles west of main highway
			8-13-69	1130	0.05	0.5 miles below spring area
			10-8-69	1410	0.1	0.5 miles below spring area
2B-3 Minersville	Ranch Creek	T27S,R9W	5-5-66	1400	0.1	
			5-29-66	0950	1.8	Upper road crossing
			5-9-68	1015	1.2	0.5 miles below upper road crossing
			4-17-69	1330	3.2	Section 32, T27S,R9W
			6-3-69	1515	0.7	100 feet below road crossing
			8-13-69	1000	0.3	Road crossing
			10-8-69	1330	0.1	Road crossing
2B-5 Cove Creek	Pine Creek	T27S,R6W	11-21-66	1110	0.3	
			5-29-68	1230	1.7	In south ditch, east of highway
			5-9-68	1330	2.0	East of gravel pit in ditch
			4-17-69	1030	0.2	.5 miles above gravel pit
			6-5-69	1130	2.0	In south ditch east of highway
			8-15-69	1100	0.3	At gravel pit-north ditch
			10-6-69	-	-	No water
	Cove Creek	T25S,R6W	4-22-65	1340	0.2	
			5-13-65	1325	0.6	1.9 miles above Cove Fort
			6-5-69	1230	0.1	1.8 miles above Cove Fort
			8-15-69	-	0.1	1.8 miles above Cove Fort
			3-16-70	1315	0.1	1.8 miles above Cove Fort
2B1-1 Coal Creek	Bowery Creek	T35S,R8W	10-9-63	1700	3.32	Above junction w/Parowan Creek
			1-30-64	-	1.17	Above junction w/Parowan Creek, well discharge 0.83 cfs
			4-10-64	-	3.50	Above junction w/Parowan Creek
			5-21-64	1300	2.14	Above junction w/Parowan Creek, clear
			9-15-64	-	5.48	Above junction w/Parowan Creek
			2-5-65	0700	1.76	Above junction w/Parowan Creek, well discharge approx. 0.5 cfs
			3-30-65	1730	4.27	Above junction w/Parowan Creek, water muddy
			3-31-65	0900	1.76	Above junction w/Parowan Creek, water clear
			6-16-65	-	3.18	Above junction w/Parowan Creek
			6-1-66	1630	8.62	Above junction w/Parowan Creek
			7-18-66	1630	7.40	Above junction w/Parowan Creek, water clear
			8-24-66	1130	4.78	Above junction w/Parowan Creek, water clear
			10-6-66	1530	3.42	Above junction w/Parowan Creek, includes well
			11-21-66	1630	2.01	Above junction w/Parowan Creek
			2-20-67	1610	1.60	Above junction w/Parowan Creek
			5-29-68	1500	5.6	50 feet above junction w/Parowan Creek
			4-15-69	1300	2.6	Section 36 T34S,R9W
			6-2-69	1630	3.9	50 feet above junction w/Parowan Creek
			8-13-69	1400	10.1	50 feet above junction w/Parowan Creek
			10-6-69	1410	2.5	50 feet above junction w/Parowan Creek
			3-17-70	1645	1.1	50 feet above junction w/Parowan Creek
	Parowan Creek		10-9-63	1700	5.0	Above junction w/Bowery Creek
			1-30-64	-	4.68	Above junction w/Bowery Creek
			4-10-64	-	6.66	Above junction w/Bowery Creek
			5-21-64	1330	47.57	Water muddy
			9-15-64	-	5.82	Above junction w/Bowery Creek
			2-5-65	0900	7.18	Above junction w/Bowery Creek
			3-30-65	1730	8.63	Above junction w/Bowery Creek
			3-31-65	0900	7.18	Above junction w/Bowery Creek
			6-16-65	-	13.62	Above junction w/Bowery Creek

TABLE 15.--(Cont.)

Watershed	Stream or drainage	Location[a]	Date of measure-ment	Time of measure-ment[b]	Discharge[c] cfs	Remarks
	Parowan Creek		5-5-66	1735	26.37	Below junction w/Bowery Creek
			6-1-66	1630	12.37	Above junction w/Bowery Creek
			7-18-66	1630	7.34	Above junction w/Bowery Creek
			8-24-66	1130	7.43	Above junction w/Bowery Creek
			10-6-66	1530	6.22	Above junction w/Bowery Creek
			11-21-66	1630	5.66	Above junction w/Bowery Creek
			2-20-67	1610	12.04	Below junction w/Bowery Creek, spring flow 0.32 cfs.
			4-29-68	1700	13.7	Left-hand fork
			4-29-68	1740	1.9	Right-hand fork
			5-29-68	1500	63.5	100' above junction w/Bowery
			4-15-69	1330	13.7	100' above junction w/Bowery
			6-2-69	1700	24.3	100' above junction w/Bowery
			8-13-69	1330	13.1	100' above junction w/Bowery
			10-6-69	1430	9.6	100' above junction w/Bowery
			3-17-70	1645	6.9	100' above junction w/Bowery
	Braffit Creek	T35S,R10W	4-29-68	1600	8.2	1 mile above highway
			5-29-68	1720	4.5	
			6-5-69	0930	1.4	1 mile above highway
			8-13-69	1600	0.4	1 mile above highway
			10-6-69	1630	0.4	1 mile above highway
2B1-4 Quichapa Creek	Quichapa Creek	T37S,R13E	8-25-66	1500	0.4	
			10-6-66	1700	0.5	
			11-22-66	1000	0.6	Bottom end of concrete ditch
			2-21-67	1030	0.7	Above concrete ditch
			5-28-68	0940	1.2	Above concrete ditch
			4-15-69	1100	12.7	Above concrete ditch
			6-4-69	1045	0.4	Above concrete ditch
			8-14-69	1645	0.5	1 mile above road in concrete ditch
			10-9-69	0900	0.6	1 mile above road in concrete ditch
			3-17-70	1445	0.7	1 mile above road in concrete ditch
	Duncan Creek	T36S,R13W	5-6-66	-	0.1	Road crossing - mouth of canyon
			10-6-66	-	5[c]	
			11-22-66	-	0.1	Road crossing creek
			5-28-68	-	40-50[c]	
			6-4-69	1130	0.2	Road crossing creek
			8-14-69	-	0.1	Road crossing creek
			10-9-69	-	20[c]	Road crossing creek
	Summit Creek	T35S,R9W	8-13-69	1500	3.0	50 yds above diversion
			10-6-69	1630	3.4	50 yds above diversion
			3-16-70	1645	2.6	50 yds above diversion
2B2-1 Pinto Creek	Meadow Creek	T37S,R16W	8-24-66	1030	1.3	Below Hyatt Spring
			10-7-66	1145	1.4	Below Hamblin townsite
				1215	1.4	Inlet to overnight storage pond
			11-22-66	1500	1.3	0.5 mile above Holt townsite
			2-21-67	1300	1.03	Main channel one mile above Holt townsite.
				1300	0.9	Diversion 1 mile above Hole townsite
			5-28-68	1420	2.1	In ditch 0.5 miles south of Forest boundary
			4-16-69	1500	10.6	In channel, S10,T37S R16W
			6-3-69	1330	2.0	In ditch at Holt townsite
			8-14-69	1230	2.2	In ditch at Holt townsite
			10-7-69	1310	2.1	In ditch at Holt townsite
			3-17-70	1030	2.2	In ditch at Holt townsite
				1030	0.4	In channel at Holt townsite
	Little Pinto	T37S,R14W	11-23-65	1215	1.8	Upper station above concrete lining
			5-6-66	-	0.9	Upper station
			6-2-66	0910	0.5	Upper station above concrete lining
			7-19-66	0910	0.1	Upper station-30' below entrance to concrete ditch
			8-24-66	-	0.1	Upper station above ranch in concrete ditch
			10-7-66	1545	0.1	Upper station above ranch in concrete ditch
			11-22-66	1215	0.3	Upper station above concrete ditch
			2-21-67	1730	0.7	Upper station above concrete ditch
			4-30-68	1015	1.0	Upper station 1 mile above Page Ranch
			5-28-68	1040	0.8	Upper station 1 mile above Page Ranch
			4-16-69	1030	11.4	Upper station-S21,T36S,R14W-at road

TABLE 15.--(Cont.)

Watershed	Stream or drainage	Location[a]	Date of measure-ment	Time of measure-ment[b]	Discharge[c] cfs	Remarks
			6-3-69	0900	2.6	Upper station 1 mile above ranch
			8-14-69	0915	0.4	Upper station 0.8 mile above ranch in ditch
			10-7-69	1600	0.2	Upper station 0.8 mile above ranch in ditch
			3-17-70	1400	-	No water
			8-24-66	-	1.0	Lower station at old Iron Town
			10-7-66	1015	1.1	Lower station below old Iron Town
			11-22-66	1130	1.2	Lower station above road crossing Iron Town
			2-21-67	1135	1.9	Lower station below old Iron Town
			5-28-68	1545	0.6[d]	Lower station-ranch at old Iron Town
			4-18-69	1000	3.6	Lower station at Iron Town
			6-24-69	0930	1.3	Lower station 1 mile above Iron Town
			8-14-69	1530	1.4	Lower station 1 mile above Iron
			10-9-69	-	1.4	Lower station 1 mile above Iron Town
	Pinto Creek	T38,R15W	11-23-65	1240	4.25	Upper station
			5-6-66	1420	18.2	Outlet of Santa Clara-Pinto diversion
				1330	17.5	0.3 miles above inlet to diversion
			6-2-66	1100	1.6	0.3 miles above inlet to diversion
				1145	3.1	3.2 miles above Pinto townsite
			7-19-66	-	1.4	Above Pinto townsite
			8-24-66	1700	1.7	3.0 miles above Pinto
			10-7-66	1445	1.4	Above Pinto
			11-22-66	1315	1.6	2.5 miles above Pinto
			5-28-68	1130	24.6	Above Pinto
			4-16-69	1130	34.2	S2,T38S,R15W
			6-3-69	1030	40.8	3.0 miles above Pinto
			8-14-69	1000	1.1	3.0 miles above Pinto
			10-7-69	1500	1.8	3.0 miles above Pinto
			3-17-70	1330	1.9	3.0 miles above Pinto
			5-6-66	-	16.8	Below Pinto
			6-2-66	1010	2.7	0.5 miles below Pinto
			7-19-66	-	0.4	Below Pinto
			8-24-66	1710	0.4	1.0 miles below town
			10-7-66	1515	1.1	Below Pinto
			11-22-66	1245	2.9	Below Pinto
			2-21-67	-	4.6	Below Pinto
			4-30-68	1115	18.0	1 mile below Pinto
			5-28-68	1130	18.6	Below Pinto
			4-16-69	1200	62.7	S24,T37S,R15W
			6-3-69	1200	30.2	1.0 miles below Pinto
			8-14-69	1100	1.7	1.0 miles below Pinto
			10-7-69	1530	1.4	1.0 miles below Pinto
			3-17-70	1230	1.5	1.0 miles below Pinto
	Spring Creek	T38S,R15W	8-24-66	1100	0.2	North end of Mountain Meadow
			10-7-66	1330	0.3	North end of Mountain Meadow
			11-22-66	1400	0.3	
			5-28-68	1315	1.7	1 mile S.E. of ranch in ditch
2B2-2 Shoal Creek	Shoal Creek	T36S,R19W	11-23-66	1235	0.3	Point above reservoir
			11-23-66	-	0.2	Point of diversion
			2-21-67	1410	0.3	Spring above Terry Ranch
			4-16-69	1400	3.9	S31,T36S,R18W
			3-17-70	-	-	No flow

[a]Location generally describes the headwater area of the stream.

[b]Times given are Mountain Standard Time except dates within May-October, 1969 and 1970 which are Mountain Daylight Time.

[c]Measured with a current meter except as noted.

[d]Measurement by Parshal Flume.

TABLE 16.--Monthly and annual flow volumes at 20, 50, and 80 percent chance occurrence for selected stations,[a] Beaver River Basin

Station	Chance of occurrence (percent)	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual[b]
Chalk Creek near	20	720	810	1350	4680	10760	4920	1640	1030	750	740	730	730	28380
Fillmore; station	50	560	620	960	2980	6550	2840	1140	760	610	620	560	560	19780
number 10-2325	80	500	500	710	1770	3990	1640	780	580	490	520	460	460	13500
1945-1968														
Beaver River near	20	1240	1120	1410	3660	11900	10840	5980	3180	1950	1620	1560	1480	43300
Beaver; station	50	1050	960	1160	2270	6470	6430	3380	1990	1370	1300	1100	1050	31590
number 10-2345	80	890	830	940	1400	3330	3920	1910	1300	1060	1050	920	880	23260
1931-1968														
Beaver River below	20	680	720	850	1460	6500	6880	6070	4800	2920	720	480	630	33230
Minersville Reservoir;	50	370	400	500	750	4140	4230	4350	3310	1450	410	290	330	22420
station number 10-2390	80	270	280	370	480	2790	2770	2900	2150	640	260	230	240	14960
1941-1968														
Coal Creek near	20	640	720	1140	4280	12210	5110	1720	1430	920	800	770	720	29360
Cedar City; station	50	540	600	900	2740	7070	2550	1140	940	610	610	590	570	20560
number 10-2420	80	460	500	740	1800	3900	1320	740	650	460	500	480	450	14250
1941-1968														

[a]Note: The analysis is based on the entire period of record shown for these stations.

[b]Annual values are based on a separate analysis and are not a sum of the monthly totals.

TABLE 17.--Monthly and annual flow volumes at 20, 50, and 80 percent chance occurrence for selected stations Beaver River Basin, 1956-1965

Station	Chance of occurrence (percent)	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual[a]
Chalk Creek near Fillmore; station number 10-2325	20	620	710	1090	4200	9940	4640	1460	900	700	670	630	610	26000
	50	530	560	820	2420	6160	2340	950	680	560	560	520	510	17660
	80	450	460	610	1420	3600	1290	640	530	460	470	440	420	11740
Beaver River near Beaver; station number 10-2345	20	1050	1000	1220	3020	9410	10380	5350	2510	1570	1390	1210	1130	38650
	50	900	870	1070	2160	6240	5280	2780	1610	1200	1120	1020	960	26650
	80	800	760	940	1690	4280	2880	1420	1100	940	940	880	860	19110
Beaver River below Minersville Reservoir; station number 10-2390	20	360	390	510	1120	4450	5040	5370	3790	1530	490	320	340	23740
	50	290	300	380	490	2700	3190	3410	2390	650	280	250	270	15120
	80	260	260	320	320	2040	2140	2160	1620	320	220	210	230	10910
Coal Creek near Cedar City; station number 10-2420	20	540	640	900	3320	10220	4890	1490	1500	1100	670	700	590	26040
	50	470	540	780	2240	5620	2140	900	1010	700	520	520	460	17600
	80	430	460	700	1790	3150	1020	560	640	460	430	410	380	12280

[a]Annual values are based on a separate analysis and are not a sum of the monthly totals.

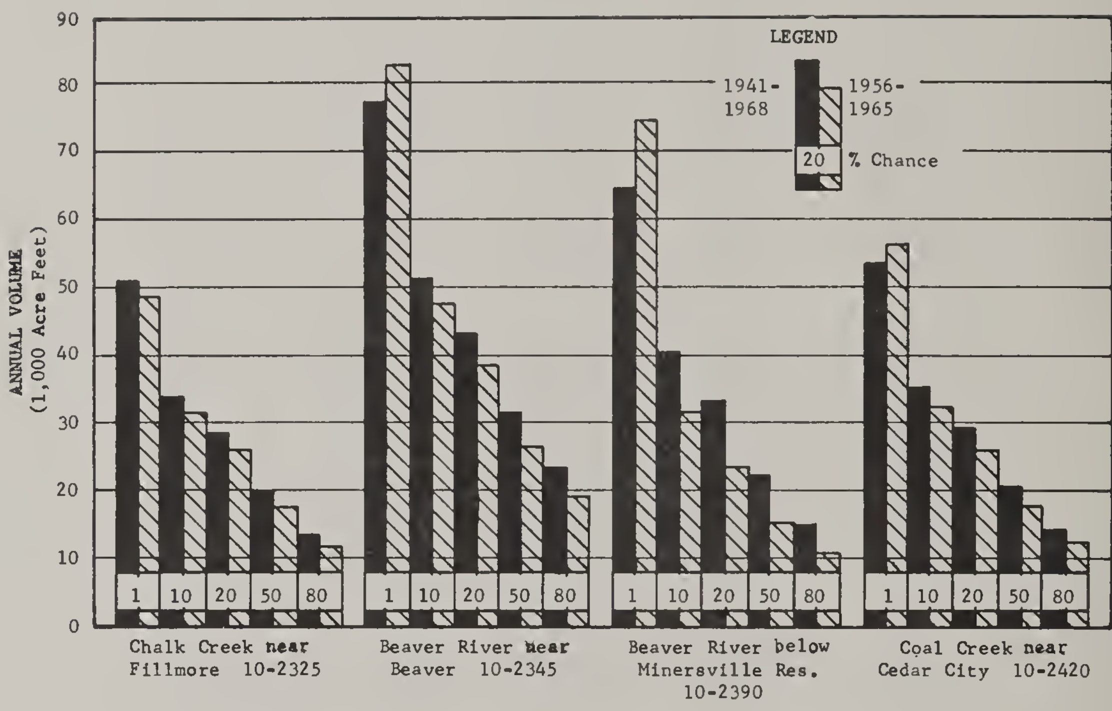


Figure 5: Stream flow at selected stations by frequency for 1956-1965 and long term record, Beaver River Basin.

TABLE 18.--Streamflow volume by frequency for selected streams in the Cedar-Parowan subbasin, Beaver River Basin, 1956-1965

Stream	Annual[a] streamflow		
	Chance of Occurrence[b]		
	20%	50%	80%
	Acre-feet	Acre-feet	Acre-feet
Little Creek	1,260	860	590
Red Creek	4,000	3,550	3,180
Center Creek	4,550	4,200	3,690
Summit Creek	3,180	2,800	2,500
Ashdown Creek	9,500	7,600	6,180

[a]Calendar year.

[b]Chance of occurrence; for example, 80% means that eight out of ten years, runoff will equal or exceed these values.

TABLE 19.--Comparison of water yield volume from Forest Service and Utah Agricultural Experiment Station maps, Beaver River Basin

Watershed		Yield: Utah Agricultural Experiment Station maps	Yield: Forest Service maps
		Acre-feet	Acre-feet
2-1	Sevier Lake	3,400	0
Total 2		3,400	0
2A-19	Tintic	0	0
2A-24	Chalk Creek	25,370	26,640
2A-25	Corn Creek	47,270	44,090
Total 2A	Fillmore	72,640	70,730
2B-1	Beaver	80,950	77,470
2B-2	Wildcat Creek	19,480	11,490
2B-3	Minersville	22,980	3,840
2B-4	Milford	0	0
2B-5	Cove Creek	5,310	7,000
2B-6	Black Rock	7,330	2,580
2B-7	Jacobs Well	0	110
Total 2B	Beaver-Milford	136,050	102,490
2B1-1	Coal Creek	57,470	51,390
2B1-2	Green's Lake	570	1,050
2B1-3	Red Creek	38,100	17,880
2B1-4	Quichapa Creek	1,180	3,200
2B1-5	Rush Lake	1,020	4,030
2B1-6	Other	810	0
Total 2B1	Cedar-Parowan	99,150	77,550
2B2-1	Pinto Creek	11,250	16,140
2B2-2	Shoal Creek	590	2,880
2B2-3	Beryl	590	0
2B2-4	Big Hollow	850	2,580
2B2-5	Other	0	460
Total 2B2	Escalante Desert	13,280	22,060

TABLE 20.-- Comparison of water yields from Forest Service maps to yields used in water budget analysis, Beaver River Basin

Water Budget Area		Yield: Forest Service maps	Yield: Water budgets 1956-1965	Correlation factor[a]
2A-24	Fillmore	26,640	23,210	0.87
2A-25a	Meadow	10,130	11,980	1.18
2A-25b	Kanosh	33,960	11,240	0.33
2A	Fillmore	70,730	46,430	-
2B-1	Beaver-Greenville	77,470	49,400	0.64
2B-2	Manderfield	11,490	4,840	0.42
2B-3, 4,6	Minersville-Milford	6,420	3,780	0.59
2B	Beaver-Milford	95,380	58,020	-
2B1-1c,2,4	Cedar	33,620	25,430	0.76
2B1-1a, 3a	Summit	5,510	2,920	0.53
2B1-1b, 3b, 3c	Parowan	34,190	24,150	0.71
2B1	Cedar-Parowan	73,320	52,500	-
2B2-1	Newcastle	16,140	2,550	0.16
2B2-2	Enterprise	2,880	3,900	1.35
2B2-3	Junction	3,030	5,400	1.78
2B2	Escalante Desert	22,050	11,850	-

[a]Used to adjust yield from Forest Service maps to yields used in water budget analysis.

GROUND WATER

Ground-water basins within the Beaver River study area are grouped into five valley areas. Escalante Valley consists of the Beryl-Enterprise, Lund, Milford and Black Rock ground-water districts.[1] Cedar Valley extends from Kanarraville on the south to Rush Lake on the north. The Red Hills divide Cedar Valley from Parowan Valley which extends from Summit to the Iron-Beaver county line and is bounded by the Black Hills on the west. Beaver Valley runs from one mile east of Beaver to Adamsville and includes the flood plain area of South Creek, Beaver River, North Creek and Indian Creek. Pavant Valley includes McCornick, Greenwood, Pavant, Flowell, Kanosh and Meadow ground-water districts.[2] McCornick, Greenwood and part of Pavant district are in the Sevier River segment of the Sevier Lake Basin.

The general ground-water movement is westward from the Tushar and Markagunt Plateau and northward toward Sevier Lake. Winn Gap provides an outlet for ground-water flow between Parowan and Cedar Valley. Cedar Valley outlets to Escalante Valley through Iron Springs Gap on the south and Twenty-mile Gap on the north. Beaver River Canyon connects Beaver Valley and Milford district of the Escalante Valley.

The ground-water movement in Pavant Valley is westward toward the basalt flows and then to Clear Lake Springs. An estimated 12,000 of the 15,000 acre-feet flow from Clear Lake Springs is attributed to ground-water flow from Pavant Valley.

Volume of ground water in storage for Pavant Valley was estimated to be 11 million acre-feet in the top 300 feet of alluvium as of March 1960.[3] Of the total, approximately 7.4 million acre-feet was within the basin boundaries. Volume of ground water storage by districts was estimated and the decrease in storage resulting from a decline in water levels of 50 feet below the March 1960 level was predicted (Table 21). An estimated 90 percent of the ground water is unrecoverable because of clay and silt aquifers.

Studies of other valleys have not shown the volume of ground water in storage. A study is currently in progress by the Geological Survey to determine storage in the Minersville-Milford area.

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[1] Sandberg, G. W., "Ground-water Resources of Selected Basins in Southwestern Utah." Technical Publication No. 13, U. S. Geological Survey in cooperation with the Utah State Engineer, 1966.

[2] Mower, R. W., "Ground-water Resources of Pavant Valley, Utah." Geological Survey Water-Supply Paper 1794, United States Geological Survey in cooperation with Utah State Engineer, 1965.

[3] Ibid.

TABLE 21.--Volume of ground water storage by district and predicted decrease in storage resulting from a 50-foot decline in water levels, Beaver River Basin, March 1960[1]

Ground-water district	Ground water in storage	Predicted decrease in storage
	(Acre-feet)	(Acre-feet)
Pavant	384,000	16,000
Flowell	4,320,000	70,000
Meadow	2,200,000	50,000
Kanosh	500,000	80,000
	7,404,000	216,000

[1]Mower, R.W., "Ground-water Resources of Pavant Valley, Utah." Geological Survey Water-Supply Paper 1794, United States Geological Survey in cooperation with Utah State Engineer, 1965.

QUALITY

Water quality data have been gathered by various agencies, organizations and individuals. The largest amount of data have been collected by the Geological Survey and published in cooperation with the State of Utah. Ground-water quality is deteriorating steadily in the Pavant and Escalante Valleys.

SURFACE WATER

Water samples were taken from selected streams during April and June, 1969 using a suspended hand sampler (US DH-48). Suspended sediment loads are shown in Table 22. Water samples were also taken during 1956 and during flood periods in 1959 and 1967 from Coal Creek. Samples 1 through 97 were taken from snowmelt flows and the remainder from summer flood flows. The results are shown in Table 23.

A study of surface water quality from selected drainages was conducted during 1964.[1,2] Portions of these findings are discussed in the following narrative.

Large volumes and concentrations of suspended sediment are transported during periods of high intensity runoff caused by summer thunderstorms. Suspended sediment concentrations are also higher during spring snowmelt runoff than during periods of low flow.

Measured suspended sediment for Chalk Creek ranged from 2,370 milligrams per liter (mg/l) at a discharge of 229 cfs on May 19, 1964 to 21 mg/l at a discharge of 0.2 cfs on September 23, 1964. Maximum measured sediment load from Corn Creek was 689 mg/l at a discharge of 80 cfs on May 19, 1964.

The dissolved solids concentration for Chalk and Corn Creeks averaged 210 mg/l and 240 mg/l, respectively. A 20 to 30 percent decrease in dissolved solids concentration was noted during periods of snowmelt flow.

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[1]Hahl, D.C. and Cabell, R.E., "Quality of Surface Water in the Sevier Lake Basin, Utah, 1964." Utah Basic-Data Release No. 10, United States Geological Survey in cooperation with State and Federal agencies, 1965.

[2]Hahl, D.C. and Mundorff, J.C., "An appraisal of the Quality of Surface Water in the Sevier Lake Basin, Utah 1964." State of Utah Department of Natural Resources Technical Publication No. 19, United States Geological Survey in cooperation with State Department of Natural Resources Division of Water Rights, 1968.

TABLE 22.--Sediment concentration from selected streams, Beaver River Basin, 1969

Location		Sample Number	Date	Time of Day	Flow CFS	Suspended Load Milligrams per liter
Quichapa Creek	R13W-T37S Sec. 1	1	4/15/69	1130	12.7	86
Bowery Creek	R9W-T34S SE¼ Sec. 36	2	4/15/69	1330	2.6	18
		3	6/ 2/69	1630	3.9	49
Parowan Creek	R9W-T34S SE¼ Sec. 36	4	4/15/69	1330	13.7	189
		5	6/ 2/69	1700	24.3	66
Little Pinto Creek	R14W-T36D Sec. 21	6	4/16/69	1030	11.4	13
Pinto Creek	R15W-T38S SE¼ Sec. 2	7	4/16/69	1130	34.2	231
		8	6/ 3/69	1030	40.8	40
	R15W-T37S Sec. 34	9	4/16/69	1200	62.7	345
	R15W-T37S SW¼ Sec. 27	10	6/ 3/69	1200	30.8	213
Meadow Canyon	R16W-T37S Sec. 10	11	4/16/69	1500	10.6	526
Ranch Creek	R9W-T27S Sec. 32	12	4/17/69	1330	3.2	976
Shoal Creek	R18W-T36S Sec. 31	13	4/16/69	1400	3.9	14

TABLE 23.--Sediment Concentration, 1956, 1959, 1967, Coal Creek, Beaver River Basin

Sample[a] Number	Location[b]	Date	Time	Sediment Concentration mg./l	Ton/day	Steamflow cfs
1	A	3-23-56	7:00 p.m.	1,010	104	38
2	A	3-27-56	7:30 p.m.	610	41	25
3	A	3-29-56	4:15 p.m.	570	32	21
5	C	4- 4-56	1:30 p.m.	500	30	22
6	D	4- 4-56	2:00 p.m.	550	25	17
7	E	4- 6-56	8:30 a.m.	180	8	16
8	F	4- 6-56	9:00 a.m.	130	5	15
9	F	4- 7-56	8:15 a.m.	250	12	18
10	E	4- 7-56	8:30 a.m.	450	21	17
11	E	4- 8-56	7:45 a.m.	710	42	22
12	F	4- 8-56	7:30 a.m.	720	25	22
13	E	4- 9-56	7:45 a.m.	390	16	15
14	F	4- 9-56	8:00 a.m.	140	6	15
15	F	4-10-56	8:45 a.m.	500	36	27
16	E	4-10-56	8:30 a.m.	850	60	26
17	E	4-11-56	8:10 a.m.	810	68	31
18	F	4-11-56	7:45 a.m.	660	55	31
19	F	4-12-56	9:10 a.m.	220	14	24
20	E	4-12-56	10:30 a.m.	270	17	24
21	E	4-13-56	9:45 a.m.	410	34	31
22	F	4-13-56	9:30 a.m.	280	23	31
23	E	4-14-56	9:45 a.m.	210	12	22
24	F	4-14-56	9:30 a.m.	180	11	22
25	F	4-15-56	6:30 p.m.	520	37	26
26	E	4-15-56	6:45 p.m.	340	24	26
27	E	4-16-56	10:10 a.m.	210	12	21
28	F	4-16-56	10:30 a.m.	110	6	21
29	F	4-17-56	9:45 a.m.	290	20	25
30	E	4-17-56	10:00 a.m.	400	26	24
31	E	4-18-56	10:00 a.m.	250	14	21
32	F	4-18-56	9:30 a.m.	200	11	21
34	E	4-19-56	12:00 noon	200	11	20
35	E	4-20-56	9:15 a.m.	300	19	23
36	F	4-20-56	9:00 a.m.	220	14	23
37	F	4-20-56	9:00 a.m.	200	12	23
38	F	4-21-56	8:30 a.m.	880	71	30
39	E	4-21-56	9:15 a.m.	820	66	30
40	E	4-23-56	9:45 a.m.	1,980	241	45
41	F	4-23-56	8:45 a.m.	450	55	45
43	F	4-24-56	9:00 a.m.	1,930	344	66
44	E	4-24-56	8:45 a.m.	2,210	400	67
45	E	4-25-56	1:00 p.m.	1,040	135	48
46	F	4-25-56	1:15 p.m.	530	66	46
47	F	4-26-56	7:45 a.m.	1,340	336	93
49	E	4-26-56	7:30 a.m.	2,950	773	97
50	E	4-27-56	8:00 a.m.	2,000	454	84
51	F	4-27-56	7:45 a.m.	1,070	248	86
52	F	4-30-56	10:10 a.m.	230	25	40
53	E	4-30-56	10:00 a.m.	270	28	39
54	E	5- 1-56	9:30 a.m.	950	159	62
55	F	5- 1-56	9:45 a.m.	630	104	61
56	F	5- 2-56	9:00 a.m.	1,250	311	92
57	E	5- 2-56	8:30 a.m.	1,840	462	93
58	E	5- 3-56	8:30 a.m.	2,220	659	110
59	F	5- 3-56	9:30 a.m.	1,580	461	108
60	F	5- 4-56	9:15 a.m.	210	58	103
61	E	5- 4-56	9:00 a.m.	2,090	593	105
64	F	5- 7-56	8:45 a.m.	3,340	694	77
65	E	5- 7-56	8:30 a.m.	2,960	631	79
66	E	5- 8-56	8:30 a.m.	2,990	622	77
67	F	5- 8-56	8:40 a.m.	4,110	854	77
68	F	5- 9-56	9:30 a.m.	2,810	508	67
69	E	5- 9-56	9:00 a.m.	2,720	507	69
70	E	5- 9-56	1:45 p.m.	2,100	391	69
71	F	5- 9-56	1:30 p.m.	2,200	409	69
72	F	5-10-56	9:30 a.m.	1,940	299	57
73	E	5-10-56	9:45 a.m.	1,640	257	58
74	E	5-11-56	8:00 a.m.	920	137	55
75	F	5-11-56	7:45 a.m.	1,070	165	57

TABLE 23.--(Cont).

Sample[a] Number	Location[b]	Date	Time	Sediment Concentration mg./l	Ton/day	Streamflow cfs
76	F	5-14-56	8:30 a.m.	440	51	43
77	E	5-14-56	8:15 a.m.	520	59	42
78	E	5-16-56	10:00 a.m.	740	90	45
79	F	5-16-56	9:30 a.m.	820	100	45
80	F	5-17-56	8:00 a.m.	1,520	242	59
81	E	5-17-56	8:15 a.m.	1,380	216	58
82	E	5-18-56	11:00 a.m.	2,650	458	64
84	F	5-18-56	11:20 a.m.	2,800	469	62
85	F	5-21-56	10:15 a.m.	2,030	548	67
86	E	5-21-56	10:00 a.m.	3,400	633	69
87	F	5-22-56	8:00 a.m.	2,250	431	71
88	E	5-22-56	8:10 a.m.	2,210	412	60
89	E	5-23-56	8:55 a.m.	2,780	570	76
90	F	5-23-56	10:05 a.m.	2,650	529	74
91	F	5-24-56	2:35 p.m.	2,680	521	72
92	E	5-24-56	3:30 p.m.	2,670	505	70
93	E	5-25-56	8:30 a.m.	3,170	676	79
94	F	5-25-56	8:45 a.m.	2,500	533	79
95	F	5-28-56	8:45 a.m.	1,980	422	79
96	E	5-28-56	8:30 a.m.	1,970	420	79
97	E	6- 4-56	3:30 p.m.	60	8	49
103	E	7-26-56	3:30 p.m.	96,811	3,398	13
104	H	7-26-56	3:00 p.m.	81,312	2,854	13
106	E	7-27-56	1:45 p.m.	125,323	3,722	11
109	J	7-23-56	7:00 p.m.	76,918	3,323	16
110	J	7-26-56	7:30 p.m.		1,709	54
111	J	7-28-56	3:20 p.m.	939,735	294,000	116
113	J	7-29-56	9:45 a.m.	196,974	32,000	60
114	E	7-29-56	10:00 a.m.	218,686	35,000	60
115	E	7-31-56	9:30 a.m.		5	14
116	E	8- 7-56	3:30 p.m.		3	9
119	J	8- 3-59	7:30 p.m.	696,816	2,258,000	1,200
120	J	8- 3-59	7:30 p.m.	615,756	1,995,000	1,200
121	E	8- 3-59	7:30 p.m.	611,340	1,981,000	1,200
122	E	8- 3-59	11:00 p.m.	375,348	101,000	100
123	J	8- 4-59	9:30 a.m.		1,000	50
124	E	7-16-67	2:00 p.m.	374,728	3,035,000	3,000

[a]Samples 1 through 97 taken from snowmelt flows, remainder from summer floods.

[b]A - Diversion below bridge on Highway 91
C - Upper Diversion
D - Ball Park Bridge
E - Coal Creek Bridge below Highway 91
F - Below right hand fork ½ mile
H - Lund Highway near airport, flood channel
J - Power Plant near Cedar City, Utah

The softest water sampled is in the Beaver River, east of Beaver.[1] Measured concentrations of dissolved solids ranged from 64 mg/l to 163 mg/l at discharges of 291 and 11 cfs, respectively. Calcium and magnesium carbonate concentrations varied from 30 mg/l to 92 mg/l. Concentrations of dissolved solids generally increase downstream. For example, the measures dissolved solids in the Beaver River at Adamsville range from 160 mg/l to 526 mg/l as compared to 64 mg/l to 163 mg/l at the sampling station east of Beaver. Increased concentrations are partially a result of irrigation return flows. Figure 6 demonstrates the relationship between discharge and dissolved solids for four selected stations on the Beaver River. Measured suspended sediment loads in the Beaver River near Beaver ranged from 1,240 mg/l on May 21, 1964 to 2 mg/l on September 24, 1964.

Samples of suspended load measurements in Coal Creek were analyzed by the Geological Survey.[2] These indicate that Coal Creek produces the largest volume of sediment of any stream in the Beaver River Basin. Base flows in Coal Creek carry sediment concentrations of 4 to 10,000 mg/l. Summer storms of August 8 and 10, 1968 produced peaks of 2,420 cfs and sediment concentrations of 120,000 mg/l and 160,000 mg/l, respectively. This is a sediment yield rate of approximately 870,000 tons per day. Particle size of the samples taken on August 8 and 9 were all smaller than 0.125 mm. dia., with 80 percent smaller than 0.016 mm. dia.[3]

Chemical analysis of water samples taken from Coal Creek show a range in dissolved solids of 447 mg/l to 1,410 mg/l. Carbonate hardness ranged from 340 mg/l to 915 mg/l.

Relative hardness and temperature range for selected streams are shown in Table 24.

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[1] Hahl, D.C., and Mundorff, J.C., "An Appraisal of the Quality of Surface Water in the Sevier Lake Basin, Utah, 1964." State of Utah, Department of Natural Resources Technical Publication No. 19, United States Geological Survey in cooperation with State Department of Natural Resources Division of Water Rights, 1968.

[2] Ibid.

[3] Water Resource Data for Utah, 1968: Part 2. Water Quality Records. United States Geological Survey in cooperation with the State of Utah and with other agencies.

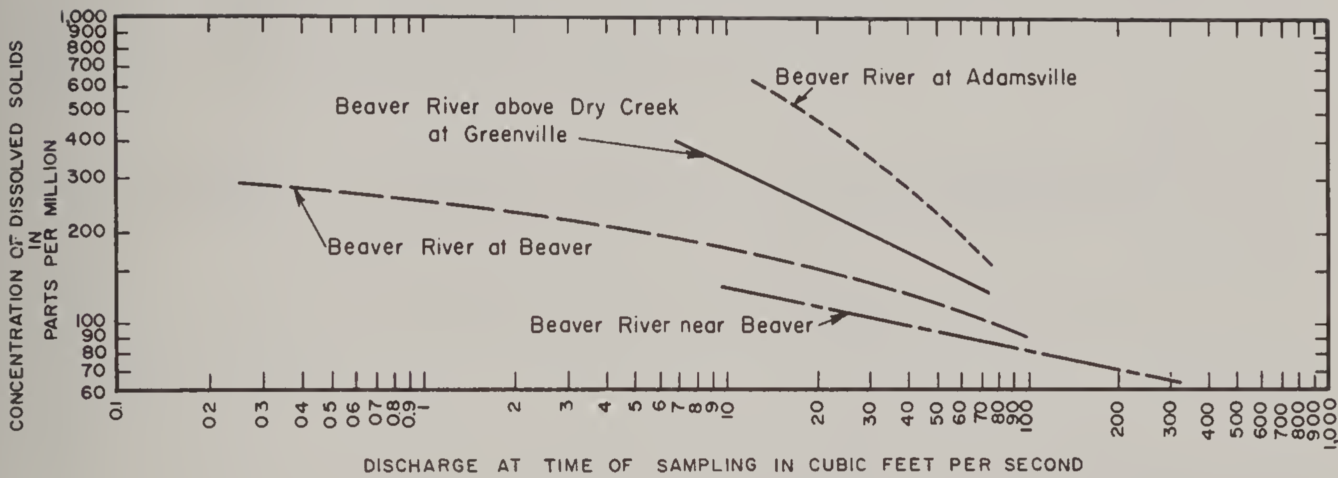

Figure 6: Relationship between discharge and dissolved solids at selected stations on the Beaver River, Beaver River Basin, 1964.

An inventory of domestic waste water facilities in Utah made in 1968 reported the towns of Beaver and Milford discharge effluent from sewage treatment facilities into Beaver River. Beaver River is normally dry at Milford. The biochemical oxygen demand (BOD) of the discharged waste was 1,400 at Milford and 410 at Beaver. Cedar City discharges effluent after treatment into an irrigation canal with intermittent flows. The BOD of the treatment effluent from Cedar City was 7,200.[1]

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[1]Domestic Wastewater Facilities in Utah, 1968 Inventory. Utah State Division of Health.

TABLE 24.--Hardness of surface water and temperature range of selected streams, Beaver River Basin

Sampling Sites	Hardness[1,2] (mg/l)	Classification[a]	Temperature range °F [1]
Chalk Creek near Fillmore	182	Very Hard	63/42
Corn Creek near Kanosh	183[E]	Very Hard	59/47
Beaver River near Beaver	56	Soft	60/35
Beaver River near Adamsville	164	Hard	82/45
Beaver River at Rocky Ford Dam near Minersville	188	Very Hard	77/56
Coal Creek near Cedar City	1256[E]	Very Hard	-----

E - Estimated

[a]Hardness values are assigned by the following classification:[1]

Soft . . . . 0-60 mg/l
Moderately Hard . . . . 61-120 mg/l
Hard . . . . 121-180 mg/l
Very Hard . . . . More than 180 mg/l

[1]Hahl, D. C., and Mundorff, J. C., "An Appraisal of the Quality of Surface Water in the Sevier Lake Basin, Utah 1964." State of Utah Department of Natural Resources Technical Publication No. 19, United States Geological Survey in cooperation with State Department of Natural Resources Division of Water Rights, 1968.

[2]Water Resource Data for Utah, 1967: Part 2. Water Quality Records, United States Geological Survey in cooperation with the State of Utah and with other agencies.

GROUND WATER

Ground-water areas include five major valleys: Pavant Valley, Beaver Valley, Escalante Valley, Cedar Valley and Parowan Valley. Detailed chemical analysis for selected wells within each valley has been made by the Geological Survey.[1,2,3,4] Ground water for general use is classified by the following criteria:[2]

Class	Dissolved Solids (mg/1)
Fresh	Less than 1,000
Slightly saline	1,000-3,000
Moderately saline	3,000-10,000
Very saline	10,000-35,000
Briny	More than 35,000

Ground water for irrigation is classified by the following criteria:[1]

	Hazard	
Class	Salinity Conductivity (Micromhos per cm at 25° C)	Sodium (Alkali) Sodium-absorption - Ratio (SAR)
Low	< 250	< 10
Medium	250 - 750	10 - 18
High	750 - 2250	18 - 26
Very high	> 2250	> 26

[1] Mower, R.W., "Ground-water Resources of Pavant Valley, Utah." Geological Survey Water Supply Paper 1794, United States Geological Survey in cooperation with the Utah State Engineer, 1965.

[2] Sandberg, G.W., "Ground-water Resources of Selected Basins in Southwestern Utah." Technical Publication No. 13, U.S. Geological Survey in cooperation with the Utah State Engineer, 1966.

[3] Sandberg, George W., "Ground-water Data." Basic-Data Report No. 6, United States Geological Survey in cooperation with the Utah State Engineer, 1963.

[4] Mower, Reed W., "Selected Hydrologic Data". Basic-Data Report No. 5, United States Geological Survey in cooperation with the Utah State Engineer, 1963.

Pavant Valley

Most wells tested in Pavant Valley during the period 1957-1960 show ground water as fresh to slightly saline. Two wells produced water with 4,300 - 4,400 mg/l dissolved solids. Ground water becomes more saline as it moves to the west and northwest.

Studies made in the Kanosh district indicate an increase in the concentration of most constituents. Figure 7 shows the relationship between water level, specific conductance, and pumpage of water from one typical well in the Kanosh district over the period 1957-1967. The increase in concentration of dissolved solids corresponds to an increase in pumping and a general lowering of the water table.[1] Ground water used for irrigation has a medium to very high salinity hazard, but a low to medium sodium hazard.

Beaver Valley

Of six wells and three springs analyzed, all produced fresh water. The salinity of ground water increases downstream toward Minersville. This is due to return flows from irrigation and concentration of salts from evapotranspiration in areas with water tables at or near the surface.

Escalante Valley

An increase in concentration of dissolved solids in ground water has been noted between Enterprise and Beryl. Figure 8 graphically presents the magnitude of increase in chemical constituents for water from one well in the Beryl-Enterprise district.[2] Ground water is fresh to slightly saline, with the poorest quality water located near Milford and in the northern half of the Beryl-Enterprise district. Most of the water analyzed has a low to medium sodium hazard and a medium to high salinity hazard for irrigation.

Cedar Valley

The ground water in Cedar Valley is fresh to slightly saline. The poorest quality is on Coal Creek fan near Cedar City. Most of the wells analyzed produce water with a low sodium hazard and a medium to high salinity hazard for irrigation.

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[1] Handy, A.H., Mower, R.W., and Sandberg, G.W., "Changes in Chemical Quality of Ground Water in Three Areas in the Great Basin, Utah". Geological Survey Research 1969: Chapter D, Pages D228-234. Geological Survey Professional Paper 650-D, United States Geological Survey, 1969.

[2] Ibid.

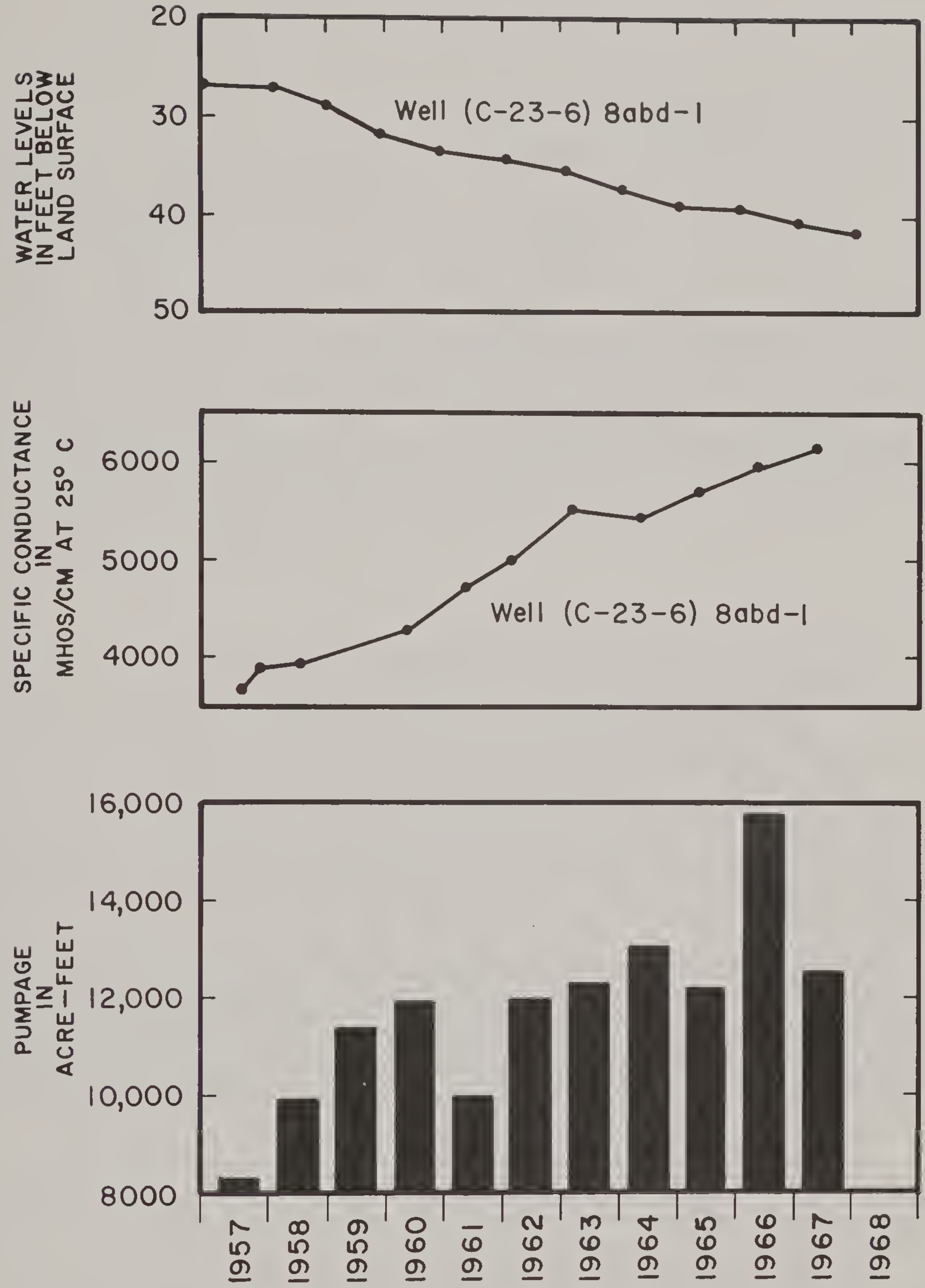

Figure 7: Relationship between water levels, specfic conductance and pumpage for the Kanosh district. Beaver River Basin

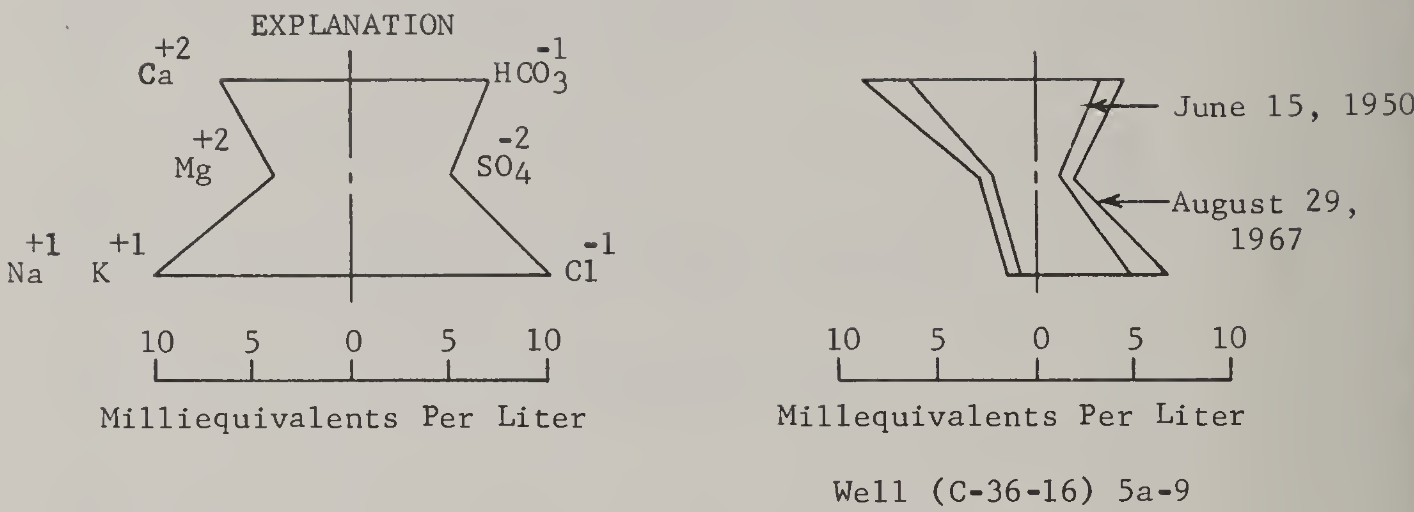

Figure 8: Increase in chemical constituents of water in the Beryl-Enterprise District, Beaver River Basin.

<u>Parowan Valley</u>

Most ground water in Parowan Valley is fresh. However, with the highly mineralized water in Little Salt Lake, it can be assumed the shallow ground water in the same general area is of poor chemical quality. Most water in the valley has a low sodium hazard and a medium to high salinity hazard.

Chapter V

FISH AND WILDLIFE RESOURCES

Fish, Birds, reptiles, and mammals are found in abundance and variety. All wildlife contribute toward making the Basin an enjoyable place to live and visit. Sport hunting and fishing utilize this resource directly but esthetic values of wildlife are becoming more important. As habitat diminishes and urban population expands, people are placing higher values on all wildlife while continuing their interest in hunting and fishing.

AQUATIC WILDLIFE

Principal game fish include Brown trout, Rainbow trout, and Cutthroat trout. Nongame fish include Redside Shiner, chubs, dace, suckers and sculpin. These nongame fish are used sometimes for food by large Brown trout but more commonly, they compete directly with trout populations for available habitat.

Reservoirs provide about 2,000 acres of lake fishing (Table 25). Fish populations are maintained by periodic stocking of fingerlings and catchable size trout. None of these reservoirs have tributary streams of suitable quality to provide natural spawning areas for planted species. Some fish, such as Brown trout, do spawn naturally.

Stream fishing habitat is not as adequate and therefore as popular as lake fishing. An intensive fish habitat survey of the streams was made in 1958 by the Utah Division of Wildlife Resources.[1]

The species of fish in each stream reach were sampled using electrical shockers to stun the fish long enough to be inventoried (Table 26). At each sample location all the fish in a one-tenth or one-twentieth mile reach of the stream were counted.

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[1] "An Inventory Survey of Utah's Fishing Waters" Utah Fish and Game, Donald C. Hales, Charley J. Stearns and Arnold Bangerten, 1958.

TABLE 25.--Location and surface area of reservoirs stocked with game fish, Beaver River Basin

Watershed		Reservoir or Lake	Surface area (acres)
2B-1	Beaver Creek	Anderson Meadow Reservoir	10
		LaBaron Reservoir	22
		Upper Kents Lake Reservoir	30
		Kents Lake #2 Reservoir	40
		Otter Lake	9
		Little Reservoir	5
		Three Creeks	60
		Merchant Valley	4
		Puffer Lake	25
		Minersville Reservoir	1,177
			1,382
2B-2	Wildcat Creek	Indian Creek Reservoir	4
		Manderfield Reservoir	29
			33
2B1-1	Coal Creek	Yankee Meadows Reservoir	60
2B1-3	Red Creek	Red Creek Reservoir	50
2B2-1	Pinto Creek	New Castle Reservoir	90
2B2-2	Shoal Creek	Upper Enterprise Reservoir	335
		Lower Enterprise Reservoir	75
			410
		Basin Total	2,025

Source: "An Inventory Survey of Utah's Fishing Waters", Utah Fish and Game, Donald C. Hales, Charley J. Sterns and Arnold Bangerten, 1958.

Habitat for fish is dependent upon many physical stream characteristics. Shade, watershed condition, turbidity, bottom fauna (insects), aquatic vegetation, and the amount of gravel or rubble covering the stream bottom were evaluated on a grade point basis of "poor", "fair", "good" or "excellent" (Table 27). The State Division of Wildlife Resources gathered information on stream velocity, volume of flow, average width, average depth, water temperature, number of pools per mile, average pool area and depth (Table 28).

TABLE 26.--Standing crop of all fish per one-tenth mile of stream section for selected locations, Beaver River Basin, 1958

Stream	Miles from mouth	Nearest landmark	Date	Dace	Redside Shiner	Chub	Sucker	Sculpin	Rainbow X Native (hybrid)	Rainbow	Cutthroat	Brown	Stream catch success (Percent)
Chalk Creek[a]	8	Forest Boundary	7-19	-	-	-	-	-	-	-	-	1	100
South Fork Chalk Creek	4	4.5 Miles West Forest Boundary	7-19	-	-	-	-	-	-	17	-	2	100
Meadow Creek[a]	4	Forest Boundary	7-19	-	-	-	-	-	-	1	-	-	70
Corn Creek[a]	8	Forest Boundary	7-19	-	-	-	2	-	-	2	-	-	80
East Fork Corn Creek[a]	1	Bridge Confluence	7-19	-	-	-	-	-	-	6	-	3	66
Second Creek[a]	2	Middle Canyon Creek Confluence	7-19	-	-	-	3	-	-	1	-	-	100
Pine Creek[a]	10	Sulphurdale Road	7-17	-	-	-	-	-	-	-	-	3	75
Wildcate Creek	15	Forest Boundary	7-17	-	-	-	-	-	-	-	-	-	-
Indian Creek	22	Manderfield Reservoir	7-16	-	-	-	-	-	1	12	-	-	-
	18	Forest Boundary	7-17	-	-	-	-	-	-	53	-	3	35
North Fork North Creek	4	4.5 Miles West Forest Boundary	7-16	-	-	-	-	10	-	9	19	-	-
South Fork North Creek	1	Forest Boundary	7-15	-	-	-	-	4	-	3	-	-	-
Beaver River	85	Road to Kent Lake	7-13	-	-	-	-	-	-	4	-	1	-
	74	Beaver	7-14	4	9	-	25	2	-	2	-	8	-
	67	Adamsville	7-15	4	-	-	2	-	-	-	-	-	-
	59	Minersville	7-15	-	-	-	-	-	-	1	-	-	-
Merchant Creek[a]	4	Sawmill Creek Confluence	7-12	-	-	-	-	-	-	49	-	1	50
Myrtle Creek[a]	11	Round Meadow Reservoir	7- 2	-	-	-	-	-	-	-	-	-	100
Bowery Creek[a]	6	Yankee Meadows Reservoir	7- 3	-	-	-	-	-	-	-	-	-	100
	14	Yankee Meadows Reservoir	7- 3	-	-	-	-	-	-	4	-	-	60
Coal Creek	11	Forest Boundary	7- 4	-	-	-	-	-	-	2	-	-	-
Little Pine Creek	3	Lower Enterprise Reservoir	7- 5	6	-	4	7	-	-	-	-	-	-
West Fork Merchant Creek	0.5	Merchant Creek Confluence	7-13	-	-	-	-	-	-	-	-	-	-
Lousy Jim Creek[a]	1	Upper Waters	7-13	-	-	-	-	-	1	-	17	-	50
	0.5	Puffer Lake Road	7-13	-	-	-	-	-	-	-	-	-	-
Hy Hunt Creek[a]	0.5	Delano Reservoir	7-12	-	-	-	-	-	-	26	1	1	70
Lake Stream Creek[a]	3	Delano Reservoir	7-12	-	-	-	-	-	-	27	-	-	60
North Fork Three Creeks	0.5	Three Creek Reservoir	7-12	-	-	-	-	-	-	22	2	1	70
Birch Creek	4	Forest Boundary	7-14	-	-	-	-	-	-	-	1	-	-
South Creek	10	Forest Boundary	7-14	-	-	-	-	-	-	3	-	5	-
Devil Creek[a]	0.5	Greenville	7-14	1	61	3	17	3	-	-	-	1	-
East Fork Baker Creek[a]	1	Puffer Lake Road	7-13	-	-	-	-	-		22	7	-	-

[a]1/20 Mile Section.

Source: "An Inventory Survey of Utah's Fishing Waters", Utah Fish and Game, Donald C. Hales, Charley J. Stearns and Arnold Bangerten, 1958.

TABLE 27.--Environmental factors used as an indication of fish habitat quality

Grade Point	Poor 1	Fair 2	Good 3	Excellent 4
Shade	0-25%	25-50%	50-75%	75-100%
Watershed	Gullies present no soil cover 0-25% bank stabilized	Gullies present shrub-or grass cover, 25-50% bank stabilized	Tree, Shrub or grass cover 50-75% bank stabilized	Heavy vegetation 75-100% of bank stabilized
Turbidity (PPM)	1500+	700-1500	300-700	0-300
Bottom Fauna (non-burrowing)	Rare	Occasional	Common	Abundant
Aquatic vegetation	Rare-rooted or algae	Occasional rooted or algae	Common rooted or algae	Abundant rooted
Bottom type (percentage of gravel and rubble)	0-25%	25-50%	50-75%	75-100%

Note: This grade point system is used in Table 28 following.

Source: "An Inventory Survey of Utah's Fishing Waters", Utah Fish and Game, Donald C. Hales, Charley J. Stearns and Arnold Bangerten, 1958.

TABLE 28.--Physical and biological character of streams, Beaver River Basin, 1958

Stream	Date	Elevation	Velocity	Volume	Width	Depth	Pools per mile	Ratio of pools	Depth of pools	Temperature	Environmental Factors[3] Shade	Watershed condition	Turbidity	Bottom type	Bottom fauna	Aquatic vegetation	Stream classification grade[4]
		Feet	FPS	CFS	Feet	In.	No.		In.	°F.	Gr.Pt.	Gr.Pt.	Gr.Pt.	Gr.Pt.	Gr.Pt.	Gr.Pt.	
Chalk Creek	7-19	5,600	3.5	50	18	10	70	1:57	18	61	4	2	4	4	2	1	B
South Fork	7-19	6,500	2.8	23	10	10	240	1:110	12	56	2	3	4	4	2	3	B
Meadow Creek	7-19	6,000	2.8	30	15	8	-	-	-	64	-	2	3	2	1	1	B
Corn Creek	7-19	5,400	3.2	40	15	10	120	1:28	12	58	2	2	4	3	2	1	B
East Fork Corn Creek	7-19	5,750	3.0	32	13	10	180	1:11	12	56	3	2	4	3	2	1	B
Second Creek	7-19	6,000	2.0	4	4	6	120	1:88	8	54	3	2	4	4	3	3	B
Little North Creek	7-17	7,175	3.0	1.5	3	2	320	1:50	4	58	4	3	4	4	1	1	C
Pine Creek	7-17	7,000	2.8	5	4	5	100	1:106	6	58	2	3	4	4	1	1	B
Wildcat Creek	7-17	-	2.1	3	7	3	100	1:62	6	56	3	2	4	4	1	1	B
Indian Creek	7-16	7,700	3.7	13	7	6	60	1:103	8	53	3	3	4	4	1	1	B
	7-17	6,800	3.7	37	10	12	130	1:17	24	53	4	3	4	4	1	1	B
North Creek	7-15	7,000	2.0	10	10	6	-	-	-	64	4	2	4	4	1	1	C
North Fork North Creek	7-16	7,500	3.0	9	6	6	160	1:25	12	57	3	3	4	3	1	1	B
	7-15	7,200	2.2	7	10	4	-	-	-	68	3	2	4	2	1	1	B
South Fork Nortb Creek	7-15	7,200	4.0	50	15	10	50	1:66	18	60	4	2	4	2	1	1	B
Beaver River	7-13	7,700	4.0	124	25	16	60	1:147	24	56	2	2	4	3	3	3	B
	7-14	6,200	2.5	45	15	12	100	1:33	4	67	3	3	4	3	3	3	B
	7-15	5,900	2.2	40	18	12	(N)	-	-	58	1	2	4	2	3	1	B
	7-15	5,800	3.5	175	25	24	60	1:55	42	64	1	3	3	2	4	4	C
Little Creek	7- 2	7,300	3.0	4	4	4	80	1:132	6	62	1	3	4	4	3	1	B
Upper Red Creek	7- 2	7,700	2.0	3.5	6	4	-	-	-	61	1	3	4	4	2	1	B
Parowan Creek	7- 3	-	2.5	14	12	5	30	1:352	9	61	3	3	4	4	2	1	B
Bowery Creek	7- 3	8,100	2.7	4.1	5	3	120	1:110	6	54	4	4	4	4	3	1	C
	7- 3	6,800	3.0	5	5	4	-	-	-	55	4	2	4	4	3	1	C
Center Creek	7- 3	8,300	5.0	30	8	9	-	-	6	46	4	4	4	4	2	4	B
	7- 3	8,100	3.5	15	5	10	30	1:147	12	50	4	3	4	4	3	3	B
Summit Creek	7- 3	6,300	2.0	4	6	4	-	-	-	68	1	2	4	4	2	1	B
Coal Creek	7- 4	7,800	2.8	5	7	4	60	1:103	18	49	-	3	4	4	2	1	B
Pinto Creek	7- 4	-	1.2	1.2	7	2	-	-	-	75	1	2	4	4	2	2	D
Grassy Creek	7- 5	5,600	0.25	1	20	4	-	-	-	58	1	3	4	4	3	4	C
Little Pine Creek	7- 5	5,800	1.3	30	15	18	100	1:33	24	68	1	3	4	1	3	4	C
Merchant Creek	7-12	9,000	3.3	4.2	15	10	250	1:13	15	52	1	3	4	4	3	3	B
Sawmill Creek	7-12	9,100	1.3	1.0	3	3	-	-	-	64	-	3	4	4	1	1	C
Deer Creek	7-13	8,800	1.5	1.5	3	4	70	1:226	5	48	2	3	4	4	1	1	C
West Fork Merchant Creek	7-13	8,700	3.8	65	20	10	40	1:660	12	45	2	3	4	4	3	3	B
Crazy Creek	7-13	8,900	2.0	0.6	2	2	(N)	-	4	52	4	3	4	4	1	1	C
Wilson Creek	7-13	9,000	1.3	1	3	3	(N)	-	4	50	3	3	4	4	1	1	C
Lousy Jim Creek	7-13	9,000	1.8	3	4	5	(N)	-	6	52	1	3	4	4	3	1	B
	7-13	8,500	2.0	4	6	4	150	1:106	6	50	4	3	4	4	3	1	B
Hy Hunt Creek	7-12	9,100	2.4	30	9	18	60	1:66	12	58	3	3	4	4	3	1	B
Lake Stream Creek	7-12	8,900	2.5	40	12	15	60	1:132	12	52	2	3	4	4	3	3	B
North Fork Three Creeks	7-12	8,800	2.0	7	10	4	140	1:47	6	54	2	3	4	4	3	1	B
Birch Creek	7-14	7,700	2.5	5	4	6	200	1:53	6	67	2	2	4	4	3	3	B
South Creek	7-14	7,800	2.6	6.5	5	6	160	1:28	12	62	4	3	4	4	3	3	B
Devils Creek	7-14	6,000	1.0	5	3.5	18	(N)	-	-	61	1	2	3	1	-	3	B
East Fork Bakers Canyon Creek	7-13	9,100	1.5	2	4	4	120	1:176	6	61	4	2	4	4	3	3	B

1/ N - Numerous
2/ Area in square feet of pools to area in square feet of riffles.

3/ Factors given in Table 27.
4 Definitions given in following narrative.

Based upon stream classifications of A, B, C, and D, 367 miles of stream were inventoried. None of the streams were within the "A" category which is defined as meadow type stream, with rooted aquatic vegetation and capable of producing many of its own creel sized fish through natural reproduction. There were 160 miles or 43 percent classed as "B" streams unable to maintain trout populations without stocking catchable size trout. There were 131 miles or 36 percent of class "C" intermittent streams that do not provide permanent trout habitat. Such streams may be stocked with catchable size trout to furnish sport on a local basis for a short period of time. The remaining 21 percent or 77 miles of class "D" stream unsuitable for trout includes 56 miles of the Beaver River that is periodically dry during the summer months due to diversion of irrigation water, and 21 miles of Pinto Creek.

TERRESTRIAL WILDLIFE

An indication of the large variety of wildlife is shown by the following list. This list is far from being all inclusive, and is a compilation of only the more common and abundant species.

BIRDS

Grebes
Eared Grebe
Western Grebe
Pied-billed Grebe

Vultures, Hawks
Turkey Vulture
Goshawk
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Swainson's Hawk
Rough-legged Hawk
Ferruginous Hawk
Golden Eagle
Bald Eagle
Marsh Hawk

Gulls
California Gull

Owls
Screech Owl
Flammulated Owl
Great Horned Owl
Pygmy Owl

Pelicans
White Pelican

Swans, Geese, Ducks
Whistling Swan
Canada Goose
Snow Goose
Mallard Duck
Green-winged Teal
Cinnamon Teal
Shoveler
Redhead Duck
Canvasback Duck
Lesser Scaup
Ruddy Duck
Common Merganser

Coots
American Coot

Goatsuckers
Poor-will
Common Nighthawk

Herons, Ibises
Great Blue Heron
Snowy Egret
White-faced Ibis

Falcons
Prairie Falcon
Peregrine Falcon
Pigeon Hawk
Sparrow Hawk

Plovers, Sandpipers
Killdeer
Common Snipe
Spotted Sandpiper
Solitary Sandpiper
Long-billed Dowitcher
Willet
Wilson's Phalarope

Grouse, Turkey
Blue Grouse
Sage Grouse
Ruffed Grouse
Turkey

BIRDS (Cont.)

Hummingbirds
Black-chinned Hummingbird
Broad-tailed Hummingbird
Rufous Hummingbird

Larks
Horned Lark

Pigeons, Doves
Bank-tailed Pigeon
Rock Dove
Mourning Dove

Flycatchers
Western Kingbird
Cassin's Kingbird
Ash-throated Flycatcher
Say's Phoebe
Traill's Flycatcher
Hammond's Flycatcher
Dusky Flycatcher
Gray Flycatcher
Western Flycatcher
Western Wood Pewee
Olive-sided Flycatcher

Mockingbirds, Thrashers
Mockingbird
Sage Thrasher

Pipits, Waxwing
Water Pipit
Bohemian Waxwing
Cedar Waxwing

Grosbeaks, Finches
Black-headed Grosbeak
Lazuli Bunting
Purple Finch
House Finch
Ros y Finch
American Goldfinch
Green-tailed Towhee
Rufous-sided Towhee
Oregon Junco

Kingfishers
Belted Kingfisher

Swallows
Violet-green Swallow
Tree Swall
Bank Swall
Rough-winged Swallow
Barn Swallow
Cliff Swallow

Swifts
White-throated Swift

Jays, Magpies, Crows
Gray Jay
Steller's Jay
Scrub Jay
Black-billed Magpie
Common Raven
Common Crow
Pinyon Jay
Clarks Nutcracker

Wrens
House Wren
Winter Wren
Canon Wren
Rock Wren

Gnatcatchers, Kinglets
Blue-gray Gnatcatcher
Golden-crowned Kinglet
Ruby-crowned Kinglet

Tanagers
Western Tanager
Hepatic Tanager

Vireos
Solitary Vireo
Warbling Vireo

Wood Warblers
Virginia Warbler
Black-throated Warbler
Yellow Warbler
Yellowthroat
Townsend's Warbler
Audubon's Warbler
Grace's Warbler

Woodpeckers
Red-shafted Flicher
Lewis' Woodpecker
Yellow-bellied Sapsucker
Williamson's Sapsucker
Hairy Woodpecker
Downy Woodpecker
Northern Woodpecker

Titmice, Bushtits
Black-capped Chickadee
Mountain Chickadee
Plain Titmouse
Common Bushtit

Nuthatches
White-breasted Nuthatch

Creepers
Brown Creeper

Thrushes, Bluebirds, Solitaires
Robin
Hermit Thrush
Western Bluebird
Mountain Bluebird
Townsend's Solitaire

Shrikes, Starlings
Northern Shrike
Loggerhead Shrike
Starling

Weaver Finches
House Sparrow

Meadowlarks, Blackbirds, Orioles
Western Meadowlark
Yellow-headed Blackbeard
Red-winged Blackbird
Bullock's Oriole
Brewers Blackbird
Brown-headed Cowbird

Sparrows
Sage Sparrow
Savannah Sparrow

BIRDS (Cont.)

Grosbeaks, Finches

Blue Grosbeak
Evening Grosbeak
Cassin's Finch
Pine Grosbean
Pine Siskin
Lesser Goldfinch
Red Crossbill
Slate-colored Junco
Gray-headed Junco

Sparrows

Brewers Sparrow
Song Sparrow
Chipping Sparrow
White-crowned Sparrow
Lark Sparrow
Lincoln's Sparrow
Black-throated Sparrow
Vesper Sparrow

MAMMALS

California Myotis
Long-eared Myotis
Long-legged Myotis
Small-footed Myotis
Brush Mouse
Deer Mouse
Great Basin Pocket Mouse
House Mouse
Northern Grasshopper Mouse
Pinyon Mouse
Western Harvest Mouse
Bushy-tailed Woodrat
Desert Woodrat
Ord's Kangaroo Rat
Long-tailed Vole
Mountain Vole
Sagebrush Vole
Big Brown Bat
Hoary Bat
Pallid Bat
Silver-haired Bat
Spotted Bat
Spotted Skunk
Striped Skunk
Gray Fox
Kit Fox
Red Fox
Golden Mantle Squirrel
Northern Flying Squirrel
Red Squirrel
Rock Squirrel
Cliff Chipmunk
Least Chipmunk
Uinta Chipmunk
Coyote
Yellow-bellied Marmot
White-tailed Prairie Dog
Mule Deer
Black-tail Jackrabbit
Cottontail Rabbit
Ringtail Racoon
Mountain Lion
Porcupine
Pronghorn Antelope
Muskrat
Weasel
Badger
Bobcat
Elk
Northern Pocket Gopher
Beaver

AMPHIBIANS AND REPTILES

Tiger Salamander
Great Basin Spadefoot
Side-blotched Lizard
Western Skink
Wandering Garter Snake
Rocky Mountain Toad
Northern Plateau Lizard
Tree Lizard
Striped Whipsnake
Spotted Night Snake
Leopard Frog
Northern Sagebrush Lizard
Mountain Short-horned Lizard
Great Basin Gopher Snake
Great Basin Rattle Snake

FURBEARERS

Although there are other furbearers, beaver are the only animals with a marketable pelt abundant enough to be sought. They inhabit most of the perennial streams and prefer habitat with abundant willow or aspen vegetation.

Most of the beaver are found in Beaver watershed. An aerial survey of this watershed in 1962 inventoried a very active population as shown by fresh cuttings at every beaver lodge (Table 29).

TABLE 29.--Aerial beaver survey, Beaver Watershed, 1962

Drainage	Dams Number	Lodges Number
Pine Creek	2	2
North Fork Merchant	2	2
Shelly Baldy	1	2
East Fork Merchant	2	2
Twin Lakes	-	2
South Fork Beaver	18	20
Ward's Cache	2	2
Cyce's Cache	2	4
Birch Creek	5	5
Ranger Pasture	5	5
Munford Reservoir	1	1
South Fork South Creek	13	13
South Creek	5	5

Source: Utah Furbearers, 1962-1963, Bulletin #63-10 Sparks, Earl A. Utah State Division of Fish and Game, page 11.

UPLAND GAME BIRDS

Upland game birds include pheasant, sage grouse, mourning dove, chuckar, partridge, forest grouse and quail. Pheasant habitat is generally found in conjuction with cultivated lands. Weed and brush patches, uncleaned fence lines and uncultivated areas intermingled with croplands make ideal habitat for pheasants.

Mourning doves and chuckars are well adapted to the extensive areas of brush and rangeland. In the desert, mourning dove distribution is often limited by lack of water.

BIG GAME

Deer

There are nine herd units within the conterminous river basin and two other units included in the Tintic Watershed. These are shown on the map following page 72. These units are selected to encompass the most common annual migration of a selected population.

The areas of summer and winter habitat are shown only for units with extensive areas of higher elevations vegetated by oakbrush, aspen or conifer (Table 30). Many of the desert mountain ranges produce only pinyon-juniper and sagebrush and a delineation between winter and summer ranges was not made.

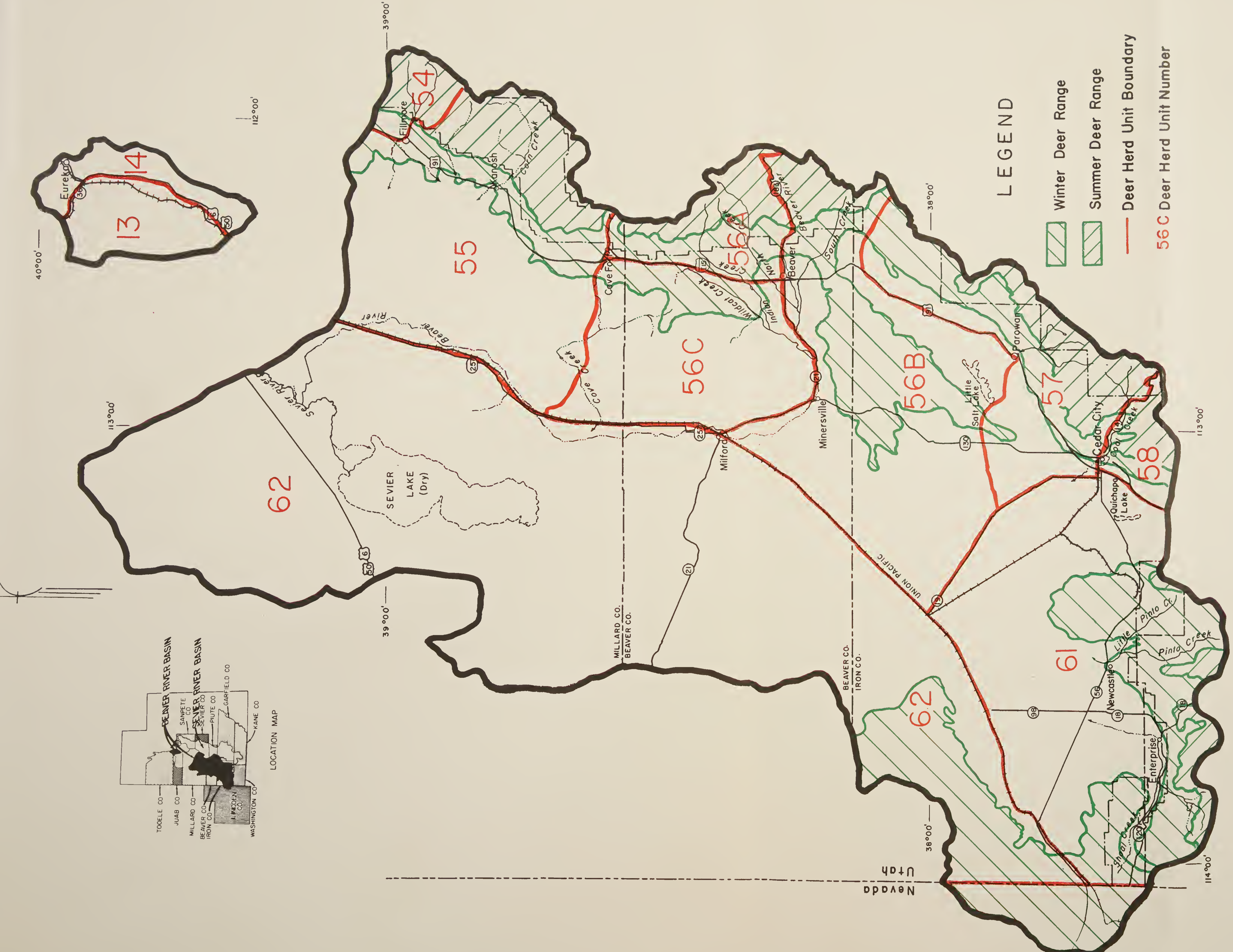
Preferred forage on winter range includes such species as bitterbrush, cliffrose, four-wing saltbush, serviceberry and others. These plants are commonly associated with pinyon-juniper. Young aspen sprouts as well as many other species of browse, forbs and grasses are utilized by deer on summer range.

Elk

Elk are found in two areas. One is on the south end of the Needles Range on the western boundary of the Basin. Elk, antelope, deer and wild horses utilize the same habitat. In this area elk were introduced on the Indian Peak Game Management area and since have extended their range southward into the Basin. In 1960, six bulls were killed and in 1961, three bulls were killed. Since this date hunting has not been allowed. They frequently utilize areas where pinyon-juniper has been removed and the area revegetated with grass. One other herd unit extends slightly into the study area. This unit lies south and east of Cedar City and south of State Highway 14. Neither unit supports sufficient elk to provide hunting on a sustained basis and their primary value is probably esthetic.

Antelope

Antelope are found in the desert and semi-desert areas. Portions of two management areas are partly within and a third unit is entirely within the Basin boundaries. The West Desert Unit is located north of U. S. Highway 6-50. About 11 percent of its area is outside the Basin. The Southwest Desert Unit is south of U. S. Highway 6-50 and north of the Union Pacific tracks with 60 percent of its area within the Basin. The Cedar City Herd Unit is south of the Union Pacific Railroad tracks and is entirely within the study area. In order to expand limited numbers of native animals, 114 animals were introduced in the Cedar City Unit and 31 animals in the Southwest Desert Unit during 1948.



DEER RANGE AND HERD UNITS

BEAVER RIVER BASIN

UTAH - NEVADA

JUNE 1971

10 0 10

SCALE IN MILES

TABLE 30.--Areas of summer and winter range by deer herd units, Beaver River Basin

Deer herd unit	Area in Basin			Total unit area
	Winter range	Summer range	Total	
Number	Sq.mi.	Sq.mi.	Sq.mi.	Sq.mi.
54	7	27	34	382
55	315	343	658	804
56A	102	118	220	220
56B	450	97	547	547
56C	1,390	96	1,486	1,486
57	239	469	708	903
58	53	22	75	672
61	516	250	766	1,269
62	2,903	-	2,903	10,548
13	47	106	153	277
14	84	17	101	876
Total	6,106	1,545	7,651	17,984

WILDLIFE POPULATIONS

Numbers of wildlife have never been inventoried. Such a determination is made difficult by their mobility, and the economic incentive has not been great enough to justify such a survey. Rather than a determination of exact numbers of animals, accurate harvest records of game species are kept and trends are determined to evaluate the affect of harvest on population.

Deer trends are determined by pellet group counts, aerial surveys, and by age and sex ratios of harvested animals. Trends for other species such as game birds are determined from sighting records, frequency of crowing, size of broods, hatching success and other information.

An evaluation was made of wildlife by ranking selected species from abundant to rare and by trend as increasing, static, or declining (Table 31). These determinations are only valid within the following framework: (1) species are evaluated in relation to their habitat. For example, 20 acres may support a deer but 20 square miles is required to support a mountain lion family and both populations would be classified as "abundant". (2) The conterminous basin is considered as an entity despite the fact that populations in one area may be increasing and in another area declining.

TABLE 31.--An evaluation of selected wildlife species by occurrence and trend, Beaver River Basin, 1970

Species	Occurrence[a]	Trend[b]
Animals		
Mule Deer	Abundant	Static
Elk	Uncommon	Static
Antelope	Uncommon	Declining
Coyote	Uncommon	Static
Kit Fox	Common	Static
Mountain Lion	Rare	Declining
Beaver	Common	Increasing
Bobcat	Uncommon	Declining
Birds		
Golden Eagle	Common	Declining
Band-tailed Pigeon	Uncommon	Static
Mourning Dove	Abundant	Increasing
Blue Grouse	Uncommon	Static
Ruffed Grouse	Common	Static
Pheasant	Common	Declining
Chuckar	Common	Increasing
Partridge	Uncommon	--
Sage Grouse	Uncommon	Declining
Predatory Hawks	Common	Declining
Turkey	Uncommon	Static

[a]Abundant - More abundant than in other areas of western states.

Common - Same as other western states.

Uncommon - Less abundant than other western states.

Rare - A rarity, species infrequently seen, often not for several years.

[b]Based on recent (10-15 year) estimates.